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FULL-SCALE STARTUP OF A SOIL VENTING-BASED IN SITU BIOREMEDIATION FIELD PILOT STUDY AT FALLON NAS, NEVADA

To

Naval Facilities Enginnering Services Center, Port Hueneme, CA

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February 1994

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FINAL REPORT

on

FULL-SCALE STARTUP OF A SOIL VENTING-BASED IN SITU BIOREMEDIATION FIELD PILOT STUDY AT FALLON NAS, NEVADA

by

J.A. Kittel, R.E. Hinchee, and M. Raj

for

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PORT HUENEME, CA 93043

February 1994

BATTELLE
505 King Avenue
Columbus, Ohio 43201-2693

Contract No. C-DAALO3-91-C0034
Delivery Order No. 0575
Scientific Service Program Task No. 92-516

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	February 18, 1994	Final Report: FM: Oct. 10, 92 to: Feb. 21, 94

4. TITLE AND SUBTITLE

Full-Scale Startup of A Soil Venting-Based In Situ Bioremediation Field Pilot Study At Fallon NAS, Nevada

5. FUNDING NUMBERS

C-DAAL03-91-C0034

6. AUTHOR(S)

J.A. Kittel, R.E. Hinchee, andM. Raj

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

Battelle
505 King Aveune
Columbus, Ohio 43201

8. PERFORMING ORGANIZATION REPORT NUMBER

DO 0575

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

U.S. Army Research Office
P.O. Box 12211
Research Triangle Park, NC 27709

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

TCN 92-516

11. SUPPLEMENTARY NOTES

Task was performed under a Scientific Services Agreement issued by Battelle, Research Triangle Park Office, 200 Park Drive, P.O. Box 12297, Research Triangle Park, NC 27709

12a. DISTRIBUTION/AVAILABILITY STATEMENT

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13. ABSTRACT *(Maximum 200 words)*

This report summarizes the first year of operation of the Navy's NAS Fallon Bioslurper system. The bioslurper system was installed to recover free-phase JP-5 from the shallow water table and to aerate the vadose zone through low flow vapor extraction (bioventing). Full-scale startup of the bioslurper system was initiated in January of 1993. Through December 31, 1993 the bioslurper system had recovered a total of 47,272 lbs of JP-5 contamination. Mass removal was 97 % in the liquid phase (free-product), 2.7 % in the vapor phase, and 0.3 % in the aqueous phase.

To date, the NAS Fallon bioslurper site indicates that oxygen concentrations in the vadose zone are not limiting biodegradation. It appears that some other site factor is limiting biodegradation.

Future work at the site will include an optimization of the free-product recovery process and the further identification of factors which my be limiting biodegradation.

14. SUBJECT TERMS

Bioventing; Bioslurping; Free-Product Recovery, Vacuum Enhanced Pumping; In Situ Biodegradation; Bioremediation

15. NUMBER OF PAGES

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT

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ACKNOWLEDGEMENTS

This work was supported by the Naval Facilities Engineering Services Center (Mr. Ron Hoeppel) under the auspices of the U.S. Army Research Office Scientific Services Program administered by Battelle (Delivery Order 0575, Contract No. DAAL03-91-C-0034).

SUMMARY

This report summarizes the first year of operation of the Navy's NAS Fallon Bioslurper system. The bioslurper system was installed to recover free-phase JP-5 from the shallow water table and to aerate the vadose zone through low flow vapor extraction (bioventing). Full-scale startup of the bioslurper system was initiated in January of 1993. Through December 31, 1993 the bioslurper system had recovered a total of 47,272 lbs of JP-5 contamination. Mass removal was 97 % in the liquid phase (free-product), 2.7 % in the vapor phase, and 0.3 % in the aqueous phase.

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FINAL REPORT

on

FULL-SCALE STARTUP OF A SOIL VENTING-BASED IN SITU BIOREMEDIATION FIELD PILOT STUDY AT FALLON NAS, NEVADA

OVERVIEW

The Naval Engineering Facilities Service Center (NEFSC) conducts research in many areas of the Navy's Installation Restoration Program, which supports the remediation of contaminated soil and groundwater. A significant problem at many Naval installations is the contamination of soil and groundwater by JP-5 jet fuel, and the Navy is investigating cost-effective methods of treating such contamination. This report summarizes the activities of a research program being conducted at Naval Air Station (NAS) Fallon, Nevada to evaluate vacuum-assisted free-product recovery and bioventing (bioslurping) for remediating a site contaminated with JP-5. Bioslurping is a term used to describe a technology application that couples light, nonaqueous-phase liquid (LNAPL) recovery and soil bioremediation.

The NAS Fallon bioslurping project was initiated in September 1991 with initial soil sampling and well installation. System construction was completed in October, and an abbreviated startup of the system was conducted in November 1991. Due to funding difficulties, the site remained dormant until January 1993, when full-scale startup was initiated. Project activities occurring from project initiation through April 1992 were summarized in a previous report, titled "Initiation of a Soil Venting-Based In Situ Bioremediation Field Pilot Study at Fallon NAS, Nevada" (Battelle, 1992). This report summarizes project activities from April 1992 through January 1994.

1.0 SCOPE

The objective of the project was to provide for the full-scale startup of a pilot-scale bioslurper system to investigate the application of bioslurping technology for the recovery of LNAPL (JP-5) from the water table and the remediation of JP-5-contaminated soils. The task included startup of the bioslurper system, system process monitoring, and operation and maintenance.

2.0 INTRODUCTION TO BIOSLURPING

Bioslurping is the adaptation and application of vacuum-enhanced dewatering technology to the remediation of petroleum-contaminated sites. Bioslurping is a combination of two remedial approaches: bioventing, to stimulate bioremediation of petroleum-contaminated soils in situ; and vacuum-enhanced free-product recovery, to extract light nonaqueous phase liquids (LNAPL) from the capillary fringe and the water table. An understanding of both technologies is necessary to understand the bioslurping technology.

2.1 Bioventing

Bioventing is the process of aerating subsurface soils to stimulate in-situ bioremediation. It is related to the soil venting (a.k.a. soil vacuum extraction, soil gas extraction, in-situ soil stripping) process. The significant difference is that soil venting is designed and operated to maximize volatilization of low-molecular-weight compounds. In most soil venting remediations, some biodegradation occurs. In contrast, bioventing is designed to maximize biodegradation of any aerobically biodegradable compound, regardless of molecular weight. In many bioventing remediations, some volatilization will occur. The significant difference in the technologies is that the objective of soil venting is volatilization, and the objective of bioventing is biodegradation. Both technologies involve venting of air through the subsurface, but the differences in objectives result in significantly different design and operation of the remedial systems.

Petroleum distillate fuel hydrocarbons, such as JP-5 jet fuel, generally are biodegradable if naturally occurring microorganisms are provided an adequate supply of oxygen and basic nutrients (Atlas, 1986). Natural biodegradation does occur and, at many sites, eventually may mineralize most fuel contamination. However, the process depends on natural oxygen diffusion rates (Ostendorf and Kambell, 1989) and as a result is frequently too slow to prevent the spread of contamination. Such sites may require remediation of the contaminant source to protect sensitive aquifers. At these sites, an acceleration or enhancement of the natural biodegradation process may prove the most effective remediation.

Important in any in-situ remediation is an understanding of the distribution of contaminants. Much of the residue of hydrocarbons at a fuel-contaminated site is found in the unsaturated zone soils, in the capillary fringe, and immediately below the water table. Because

seasonal water table fluctuations typically spread residues in the area immediately above and below the water table, a bioremediation effort must treat these areas to be successful. Bioventing can provide oxygen to unsaturated zone soils.

A system that uses forced air as the oxygen source to increase the microbial biodegradation of fuel hydrocarbons in the vadose zone is a cost-effective alternative to conventional systems. This process stimulates soil-indigenous microorganisms to metabolize fuel hydrocarbons aerobically in unsaturated soils. Depending on airflow rates, volatile compounds may be removed simultaneously from contaminated soils.

By using air as an oxygen source, the minimum ratio (based on stoichiometry) of air to hydrocarbon on a mass basis is approximately 13:1. This compares with over 10,000:1, water: hydrocarbon, for a conventional waterborne enhanced bioreclamation process. An additional advantage of using an airborne process is that gases have greater diffusivity than liquids. At many sites, geological heterogeneities present an added problem with a waterborne oxygen source because fluid pumped through the formation is channeled into the more permeable pathways. For example, in an alluvial soil with interbedded sand and clay, all of the initial fluid flow will take place in the sand. As a result, oxygen must be delivered to the less permeable clay lenses through diffusion. In a gaseous system (as is found in unsaturated soils), this diffusion can be expected to take place at a rate several orders of magnitude greater than in a liquid system (as is found in saturated soils). It is not realistic to expect diffusion to aid significantly in water-based bioreclamation, but diffusion in an air-based application, may be a significant mechanism for oxygen delivery to less permeable zones.

The significant features of bioventing technology include the following:

- Airflow is optimized to reduce volatilization while maintaining aerobic conditions for biodegradation.
- Local soil gas conditions are monitored to ensure aerobic conditions, in addition to monitoring vent gas composition.
- Moisture and nutrients are added as required to increase biodegradation rates although field studies indicate that this may not be necessary at many if not most sites.
- The water table is manipulated as required for air/contaminant contact.

2.2 Vacuum-Enhanced Pumping Free Product Recovery

Vacuum-enhanced recovery is a common pumping technique used in construction dewatering projects (Powers, 1981). Vacuum-enhanced pumping involves the application of a negative pressure to a well-point system to increase rate of flow of groundwater into the wells. In recent years, vacuum-enhanced pumping has been applied to groundwater remediation pump-and-treat systems and to LNAPL recovery systems. Blake and Gates (1986) report increased groundwater extraction rates and increased residual hydrocarbon (LNAPL) recovery through the use of vacuum-enhanced pumping. Blake et al (1990) report applying vacuum-enhanced pumping techniques to hydrocarbon-contaminated sites to facilitate, (1) increased liquid recovery and gradient control, (2) vapor and residual hydrocarbon recovery, and (3) combined vapor recovery and gradient control. Reisinger et al (1993) report enhancing groundwater extraction by a factor of 47% with use of vacuum extraction.

Two important factors that influence the movement of fluids into a recovery well are hydraulic gradient (head difference) into the well and aquifer transmissivity (the rate at which groundwater moves through a unit thickness of the aquifer). Vacuum-enhanced recovery improves recovery rates by increasing hydraulic gradient and increasing aquifer transmissivity.

Conventional dual-pump free-product recovery (FPR) systems increase hydraulic gradient into a well by setting a pump below the water table to establish a cone of depression around the well. Free product then flows down the gradient into the well to be recovered by a second extraction pump. Vacuum-enhanced pumping systems use the same concept, except that the cone of depression is actually a cone of reduced pressure around the well. Fluids then flow across the pressure-induced gradient, from higher pressure outside the well to lower pressure inside the well. The transmissivity of the saturated zone is an intrinsic characteristic of an aquifer and is a function of the hydraulic conductivity and the aquifer saturated thickness. Vacuum-enhanced pumping increases transmissivity by decreasing the pressure head on the aquifer to, in effect, increase the saturated thickness of the aquifer. The sum effect of the increase in hydraulic gradient and the increase of aquifer transmissivity is to increase the volume of fluids that can be extracted from a well during a unit of time.

Suction lift might appear to be a limitation to application of vacuum enhanced dewatering. In theory, the maximum suction lift attainable with an extremely efficient vacuum pump is approximately 25 ft, depending on elevation (Powers, 1981). In practice, however, greater suction

lifts are attainable. Lifts greater than the theoretical maximum can be attained when the extracted fluid is not only water but a mixture of soil gas bubbles and groundwater (Powers, 1981). A mixture of soil gas and water has a specific gravity less than 1.0 and can therefore be lifted higher than a standard water column. Extractions that also include LNAPL (liquid with a specific gravity < 1.0) would add to this effect. Another phenomena that can help in achieving greater than the theoretical suction lift is liquid entrainment or entrapment. Liquid entrainment occurs when the primary extraction fluid is soil gas, rather than a liquid. At high velocities, extracted soil gas can entrap water droplets and carry them to the surface at relatively high total liquid extraction rates.

2.3 Bioslurping

Traditional handling practices and past spills and leaks have caused petroleum releases to the environment at most industrial and government fuels-handling facilities. When a fuel release occurs, the contaminants may be present in any or all of the three phases in the geologic media:

- absorbed to the soils in the vadose zone
- floating on the water table in free-phase form
- in solution phase dissolved in the groundwater.

Of the three phases, dissolved petroleum contaminants in the groundwater are considered of the greatest concern due to risk of human exposure through drinking water. However, because the liquid- and absorbed-phase hydrocarbons act as feedstocks for groundwater contamination, any remedial technology aimed at reducing groundwater contamination must address these contaminant sources.

At many contaminated sites, petroleum contamination is present in both the vadose zone and the capillary fringe as free product. Regulatory guidelines generally require that free-product recovery take precedence over other remediation technologies, and conventional wisdom has been to complete free-product removal activities before initiating vadose zone remediation. This "phased" approach to site remediation is costly and slow because conventional FPR technologies have little or no effect on soil contamination; when FPR is complete, a second remediation system must be installed, operated, and maintained to treat residual soil contamination.

"Bioslurping" is a new, dynamic technology application that teams free-product recovery with bioventing to simultaneously recover free-product and remediate the vadose zone. Bioslurping is a vacuum-enhanced free-phase petroleum recovery technology. Unlike other FPR technologies, bioslurping systems treat two separate geologic media simultaneously. Bioslurping pumps are designed to extract free-phase fuel from the water table and to aerate vadose zone soils through soil gas vapor extraction. The systems can be designed also to achieve hydraulic control, as is true of conventional "pump-and-treat" technology. The bioslurper system uses a single pump withdraw groundwater, free product, and soil gas in the same process stream. Groundwater is separated from the free product, is treated (when required), and discharged. Free product is recovered and can be recycled. Soil gas vapor is treated when required and discharged.

The bioslurper technology is unique because it uses elements of two separate remedial technologies, **bioventing** and **free-product recovery**, to address two separate contaminated media.

1. **Bioventing** – Bioventing is the process of using forced aeration to enhance natural in situ bioremediation of petroleum contamination in the vadose zone. Bioventing is accomplished through either air injection or soil gas extraction.

2. **Free-product recovery** – Free-product recovery (FPR) is the process of removing free-phase petroleum from the capillary fringe in liquid form. FPR generally is accomplished by using either a skimmer pump to pump out any fuel that enters a monitoring well or a dual-pump recovery system. In a dual-pump system, one pump lowers the water table and increases the flow of fuel into the well (due to the gravity-induced gradient), and the second pump skims off the fuel.

Both technologies are used widely in some form. Bioslurping combines elements of each to simultaneously recover free product and aerate vadose zone soils, thus enhancing the capabilities of each used alone. Conventional FPR skimmer systems generally are inefficient for FPR because they have little effect on free product outside the recovery well, and their efficiency relies on the passive movement of fuel into the recovery well. Dual-pump FPR systems increase recovery efficiency by drawing the water table down several feet to create a hydraulic gradient into the well. Although higher recovery rates are achieved, creation and maintenance of the hydraulic gradient can require extraction of large volumes of groundwater that must be treated prior to discharge. In

addition, lowering the water table may serve only to trap much of the free product in the newly exposed vadose zone so that it reappears when the water table returns to its normal level.

Bioslurping improves free-product recovery efficiency without requiring the extraction of large quantities of groundwater. The slurper system pulls a vacuum of up to 20 inches of mercury on the recovery well to create a pressure gradient that forces movement of fuel into the well. The systems are operated to cause very little drawdown in the aquifer, thus reducing the problem of free-product entrapment.

Bioventing of the vadose zone soils is achieved by withdrawing soil gas from the recovery well. The slurping action of the bioslurper system cycles between recovering liquid (free product and/or groundwater) and soil gas. The rate of soil gas extraction depends on the recovery rate of liquid into the well. When free-product removal activities are complete, the bioslurper system is easily converted to a conventional bioventing system to complete remediation of the vadose zone soils.

Bioslurper systems are designed to minimize environmental discharges of groundwater and soil gas. Like bioventing systems, bioslurpers extract soil gas at a low rate to reduce volatilization of contaminants. In some instances, volatile discharges can be kept below treatment action levels. The slurping action of a bioslurping system greatly reduces the volume of groundwater that must be extracted compared to conventional FPR systems, with a corresponding reduction in groundwater treatment costs. Figure 1 illustrates the differences between conventional dual-pump FPR and bioslurping.

The significant features of this technology include the following:

- Enhances FPR via vacuum-enhanced pumping.
- Simultaneously treats vadose zone via bioventing.
- Reduces ratio of groundwater extracted per gallon of fuel recovered, as compared to conventional dual-pump recovery systems.
- Can be designed to dewater to expose contamination below the water table (at sites where water table fluctuations occur) or to achieve hydraulic control.
- Is designed to require only one pump to extract from multiple wells, reducing capital costs compared to dual-pump and skimmer systems.
- Provides suction lift greater than the theoretical maximum due to liquid entrapment.
- System can be converted easily to a conventional bioventing system (air injection or extraction) when FPR activities are completed.

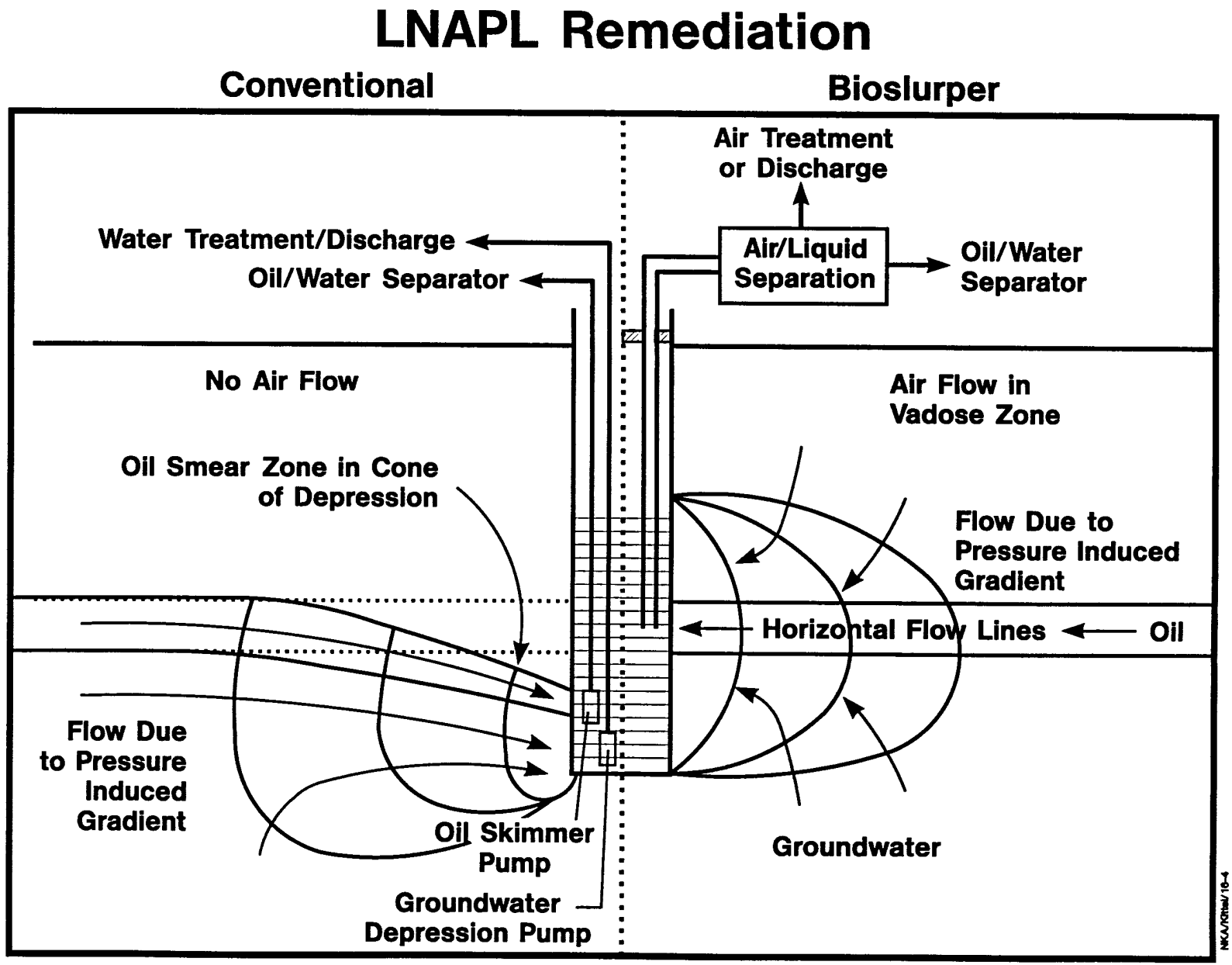

Figure 1. Comparison of Conventional Dual-Pump Free-Product Recovery and Bioslurping.

3.0 SITE DESCRIPTION

NAS Fallon is located six miles southeast of the town of Fallon, Nevada, and sixty miles east of Reno. NAS Fallon was established as a military facility in 1942 as part of the Western Defense Program (ORNL, 1991). The base was commissioned as a Naval Air Auxiliary Station (NAAS) in 1944 and went through varying degrees of activity through the 1950s and 1960s before being upgraded to Naval Air Station in 1972 (ORNL, 1991). NAS Fallon serves as an aircraft-weapons delivery and tactical air-combat training facility.

3.1 Climate

The climate is semiarid, having approximately 5 inches of precipitation per year. Average summer high temperatures are in the low 90s (degrees Fahrenheit) with low humidity, and average winter lows are in the upper teens.

3.2 Geologic Setting

The Fallon area is in the northwestern part of the Great Basin. Valley fill consists of great thicknesses of lake-laid materials interwedged with river alluvian and aeolian material deposited during interpluvial periods (USDA, 1975). Soils in the developed part of the base (and in the area of the bioslurping site) are primarily of the Appian complex, consisting of fine sand and clay loam to a depth of approximately 6 ft (USDA, 1975). Underlying these soils are alternating layers of clay, silty/clayey sand, and sand. Groundwater on the base generally is encountered at 5 to 10 ft below the ground surface. Groundwater quality varies greatly across the site; groundwater in many areas has high dissolved-solids content and high alkalinity.

Battelle's investigation activities at the bioventing site show that surface soils consist of loose sand to approximately 5 ft, followed by alternating layers of varying thickness of clay, sandy/silty clay, clayey/silty sand, and sand (Battelle 1992).

Groundwater is present at approximately 9 ft below ground surface on the bioslurping site. Free product is visible in most site wells, with apparent free product thicknesses ranging up to 2 ft.

4.0 SYSTEM CONSTRUCTION

4.1 Well Installation

The bioslurper demonstration site is in a vacant field located west of the NAS Fallon fuel farm. The system was installed on approximately one acre located just south of a JP-5 supply pipeline pumphouse (see Figure 2). Forty-eight 2-inch-diameter schedule 40 pvc bioslurper extraction wells were installed during the initial site investigation activities (Battelle, 1992). The system extraction wells were placed on a 30′ x 30′ grid (six rows with 8 wells each) at the upgradient edge of a previously defined free-product plume (ORNL, 1991).

Construction of the bioslurper wells followed the basic procedures used for groundwater monitoring well construction. The wells were installed inside a 4.25-inch hollow stem auger at depths ranging from 12.0 ft to 16.5 ft, with 5.0 ft to 7.0 ft (10 slot) screened intervals (Battelle, 1992). A medium-grade silica sand was installed across the screened interval of each well, with a hydrated bentonite seal near the surface and a concrete cap at the surface. Each well was completed with a 6-inch stick-up. In addition to the bioslurper extraction wells, four groundwater monitoring wells were installed on the test site, and one uncontaminated background monitoring well was installed.

4.2 System Components

The above-ground components of the Fallon bioslurper system are shown in Figure 3. The first bioslurper pump installed was a 10-hp (460-V, 3-phase) vacuum-assisted dewatering pump constructed and installed by Gator Dewatering, Inc., of Panama City, Florida. The pump vacuum unit separates soil gas from the process stream and discharges the gas to the atmosphere under permit. (See Appendix A for copies of the Nevada Department of Environmental Protection (NDEP) discharge permits.) A 24-gpm oil-water separator (Megator Corp., Pittsburgh, Pennsylvania) is connected to the pump-effluent line to receive groundwater and free product. A 500-gal fuel tank receives any skimmed product, and groundwater gravity drains into a 140-gal pvc transfer tank. A 5-hp, float-switch-activated irrigation pump transfers groundwater to the NAS Fallon sanitary sewer under NDEP permit (Appendix A). A flow totalizer meter quantifies the volume of groundwater discharged to the sanitary sewer.

The dewatering pump is connected to a 6-inch-diameter schedule 40 pvc manifold that splits into three banks to tie into each bioslurper well via 1-inch-diameter suction lines. Figure 4

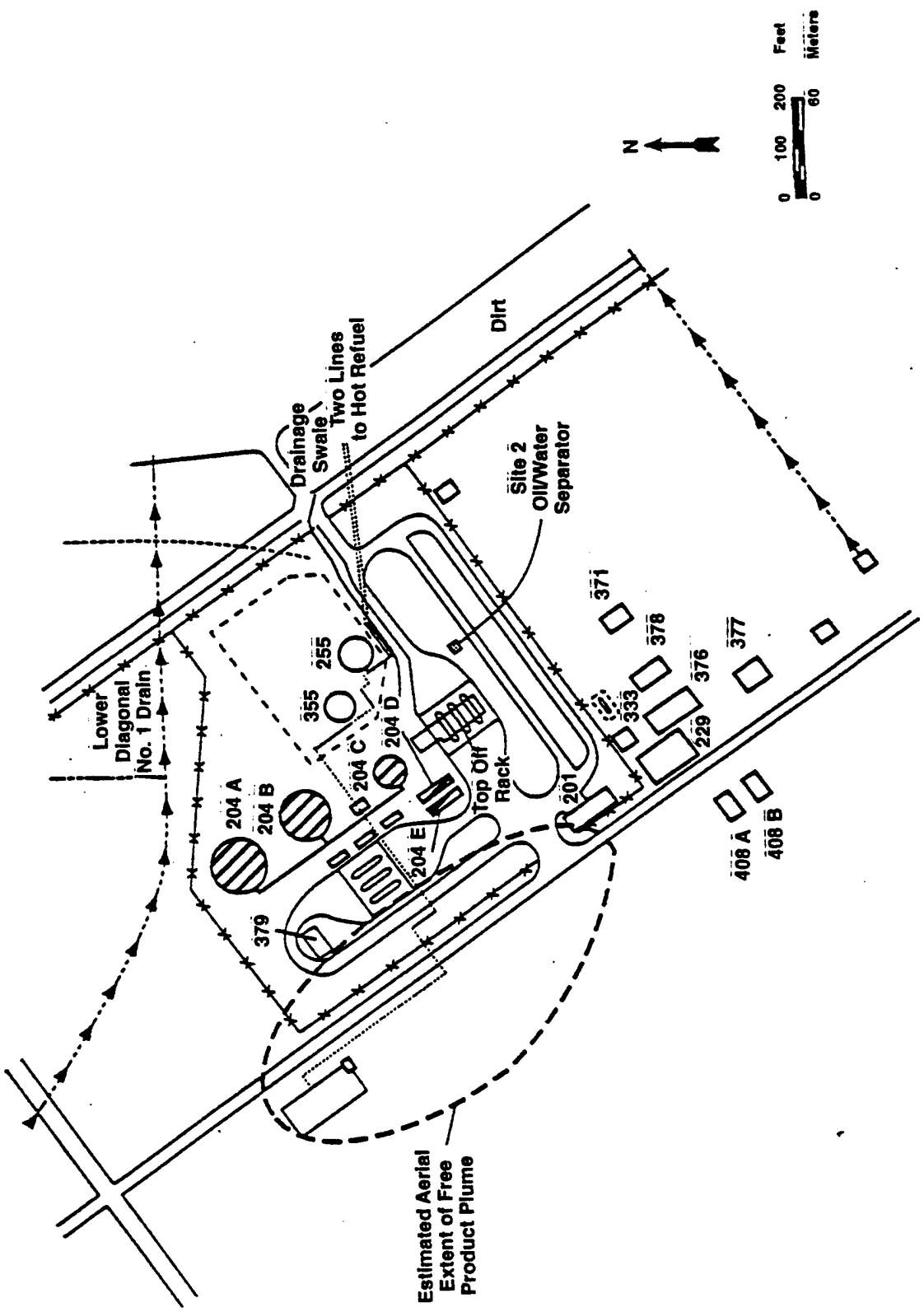

Figure 2. Estimated Aerial Extent of JP-5 Free Product Plume West of NAS New Fuel Farm. Bioslurper System Treats an Approximate 1-Acre Plot Within Plume.

Bioslurper Aboveground Components

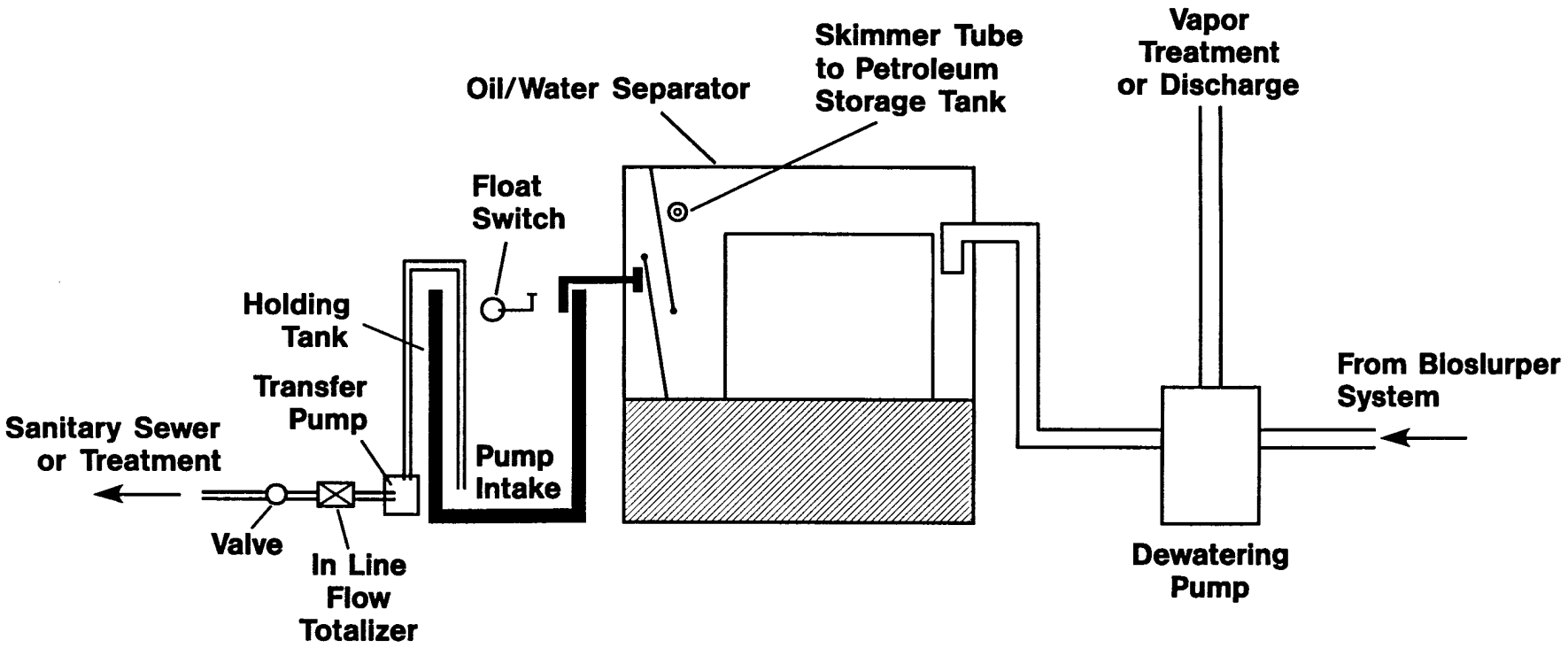

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Figure 3. Diagram of Bioventing System Components. (not to scale)

NAS Fallon Site Diagram

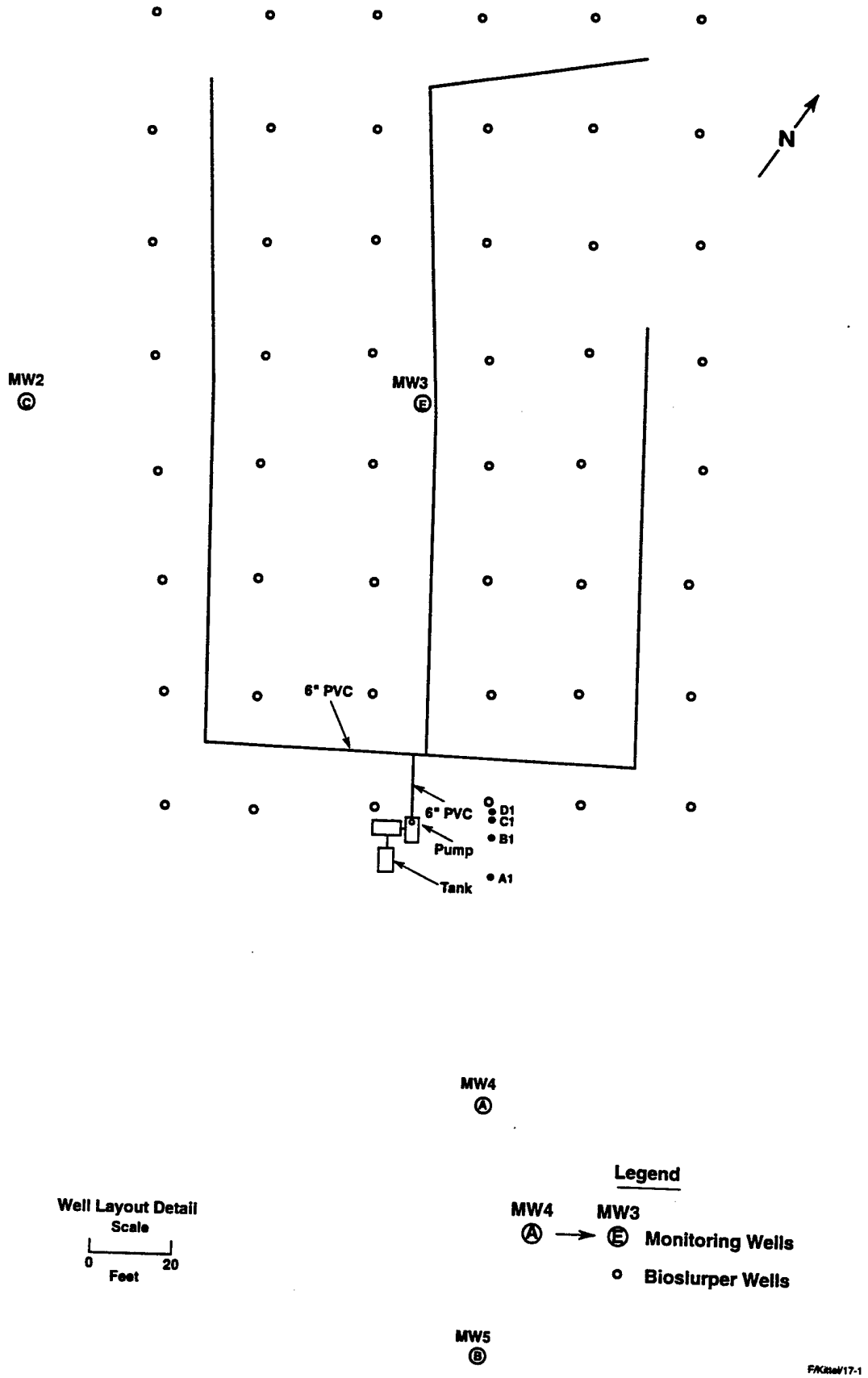

Figure 4. NAS Fallon Bioslurper Well Configuration.

shows the bioventing system well layout and manifold configuration. Each 1-inch suction line is connected to a 1-inch pvc drop tube, which enters the well head through a vacuum-tight seal and extends to the groundwater/product interface in each well (See Figure 5). A 12-inch section of clear pvc tube at the top of the drop tube allows for visual inspection of extraction fluids. A 2-inch tee and a ball valve were placed at the wellhead of each extraction well to allow for release of the vacuum from the well.

Bioslurper Well Design

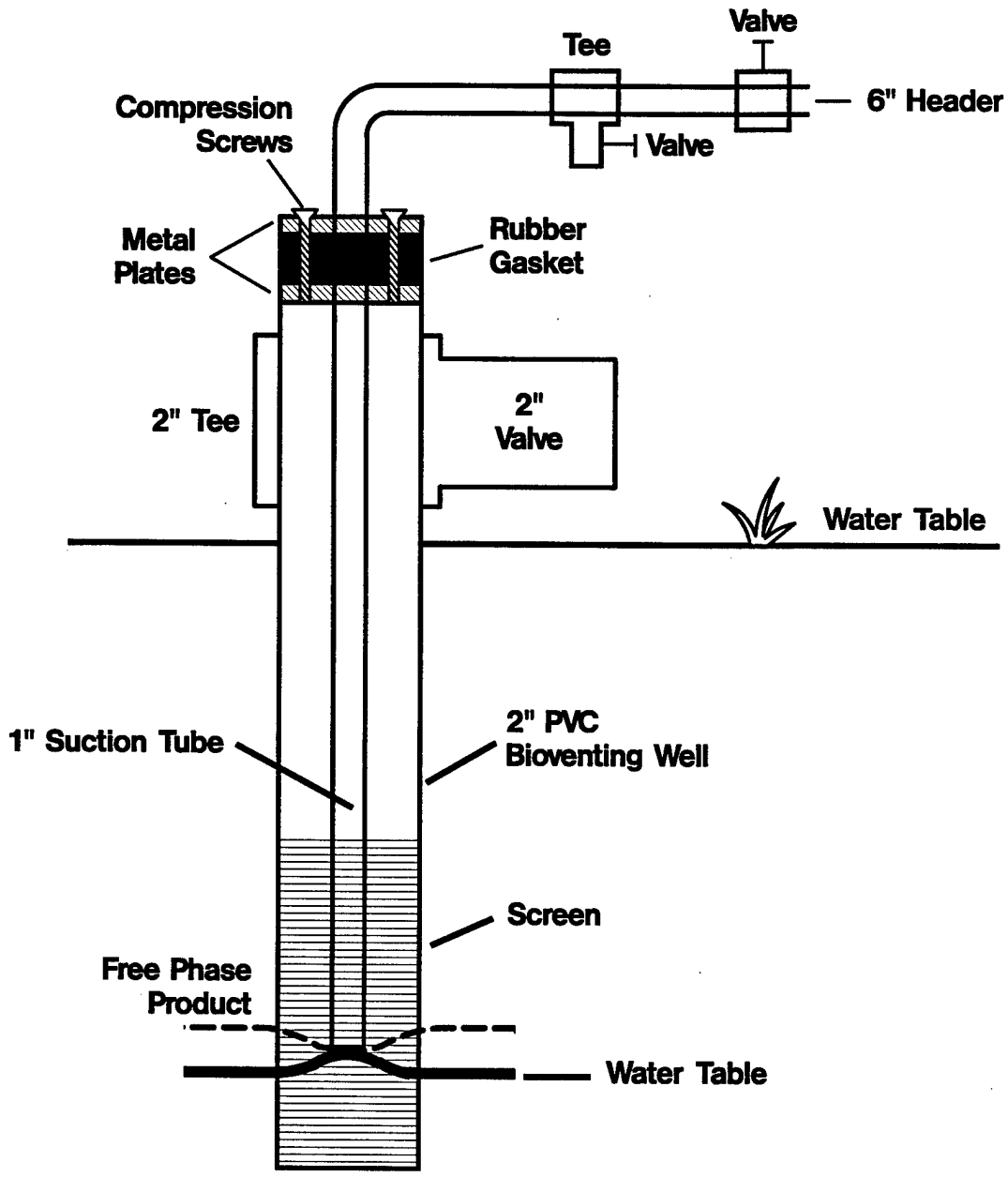

Figure 5. Bioslurper Well Design.

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5.0 SYSTEM STARTUP

5.1 Abbreviated Startup

Once system construction was complete, a short-term operational test of the bioslurping system was conducted. The NDEP granted a temporary permit to operate the bioslurping system and discharge the aqueous effluent to the NAS Fallon sanitary sewer. The permit covered operation of the system for 10 days. The Nevada Division of Water Resources granted a groundwater discharge waiver to operate the system for a net 72 hours and to pump a maximum 18,000 gal. Unfortunately, due to difficulty in obtaining the power hook-up for the site, the test could not begin until the last day the temporary discharge permit was effective.

A short-term startup of the bioventing system was performed on November 8, 1991. The dewatering pump was turned on for approximately 1 hour. Initially, very little fluid was being withdrawn from the bioventing wells, even though the system was under approximately 10 inches Hg vacuum. Flow was increased greatly when the flow to each well was restricted slightly by adjusting the 1-inch ball valves that controlled flow from each well's suction tube. All of the 2-inch ball valves that control the vacuum at each well were closed.

During the short test, approximately 75 gal of fluid were processed through the system's oil/water separator (OWS). Approximately 50 gal of groundwater and 25 gal of free product were processed. (These volumes do not account for dead volume of the bioventing system). The test was terminated after one hour because a sheen of free-phase petroleum was observed being discharged with the aqueous phase to the transfer tank. This problem likely was caused by having an insufficient volume of water in the OWS prior to starting the test. The test could not be restarted because the temporary discharge permit expired that day.

During the test run, two canisters of the stack discharge were collected for petroleum constituent analysis. The analysis showed relatively low concentrations of petroleum hydrocarbons being discharged to the atmosphere. The highest TPH concentration detected was 90.1 ppm. The highest benzene concentration detected was 2.1 ppm (Battelle, 1992).

The results of the abbreviated startup indicate that the system will be effective in recovering freeproduct from the bioventing site.

5.2 Process Monitoring

In conjunction with the full-scale startup, a process monitoring program was put in place to evaluate the performance of the bioslurper system. A process monitoring program consists of tracking the mass of petroleum hydrocarbons removed in liquid, dissolved, and gaseous forms. In addition, in situ respiration tests are conducted to determine biodegradation rates and the mass of JP-5 mineralized.

Free-product recovery volumes are measured daily by pumping the fuel out of the 500-gal steel holding tank into a 4,000-gal holding tank supplied by NAS Fallon. Fuel volume is quantified via a flow totalizer on the transfer pump. Recovered fuel is removed from the site to be recycled by the NAS Fallon Environmental Department on an as needed basis.

Monthly water samples are taken from the OWS effluent to track dissolved petroleum concentrations and to confirm proper operation of the OWS.

The vapor discharge from the bioventing system is sampled periodically at the vacuum assembly stack to track the mass of petroleum hydrocarbons volatilized and ensure compliance with the air-discharge permit.

The vast majority of hydrocarbon mass removed will be in the liquid (free-product) phase as long as free product is being recovered. Since free-product recovery rates have remained constant during the first year of operation, monitoring of aqueous and gaseous phase hydrocarbons has been kept at the regulatory requirement minimum. The process monitoring program will be modified as site conditions warrant.

Table 1 summaries bioslurper system operational data for 1993.

5.2.1 Free-Phase Recovery

Full-scale startup of the bioslurper system was initiated on January 11, 1993. The system is operated continuously with brief shutdowns for system maintenance and occasional site monitoring. From January 11 through December 31, 1993, the system operated for a cumulative 6,556 hrs, or approximately 39 weeks. Total free product recovered was 6,469 gal, an average rate of 24 gal/day. Figure 6 presents the free-product recovery data for the first year of operation. The total mass of hydrocarbons removed from the site in the liquid phase was 45,859 lbs (170 lbs/day), based on an assumed specific gravity of 0.85 for JP-5 fuel.

Total groundwater recovered was 180,385 gal for an average extraction rate of 0.46 gal per minute (gpm). Figure 7 presents the recovery data for fuel and groundwater during the first

Table 1. System Operation Data Summary Sheet

Date at end of Week	Approx Week*	Hours System Operation (hrs)	Cumulative System Operation (hrs)	Water Discharged Weekly (gal)	Water Discharged Cumulative	Fuel Recovery Weekly (gal)	Fuel Recovery Cumulative
01/21/93	1	180.00	180.00	5,841	5,841	54	402
01/28/93	2	166.00	346.00	2,695	8,536	195	597
02/04/93	3	164.83	510.83	2,085	10,621	164	760
02/11/93	4	163.17	674.00	1,629	12,250	148	908
02/18/93	5	164.58	838.58	3,046	15,296	162	1,070
02/25/93	6	146.67	985.25	2,803	18,099	142	1,212
03/04/93	7	165.83	1,151.08	3,305	21,404	169	1,380
03/11/93	8	166.08	1,317.17	3,155	24,559	159	1,540
04/01/93	9	180.75	1,497.92	5,686	30,245	324	1,977
04/08/93	10	161.25	1,659.17	3,877	34,122	181	2,158
04/15/93	11	166.00	1,825.17	4,167	38,289	147	2,306
04/22/93	12	172.50	1,997.67	3,355	41,644	113	2,418
04/29/93	13	168.00	2,165.67	2,613	44,257	75	2,493
05/06/93	14	192.75	2,358.42	3,315	47,572	141	2,635
05/13/93	15	166.25	2,524.67	3,673	51,245	79	2,714
06/05/93	16	192.75	2,717.42	4,575	55,820	89	2,802
06/16/93	17	173.50	2,890.92	3,506	59,326	73	2,876
06/24/93	18	166.50	3,057.42	3,627	62,953	56	2,932
07/01/93	19	166.25	3,223.67	3,646	66,599	83	3,014
07/08/93	20	158.75	3,382.42	3,022	69,621	52	3,067
07/15/93*	21	166.75	3,549.17	2,314	71,935	314	3,381
07/29/93	23	255.00	3,804.17	425	72,360	63	3,443
08/12/93	24	152.75	3,956.92	2,580	74,940	36	3,479
08/19/93	24	72.00	4,028.92	1,543	76,483	17	3,496
08/26/93	25	159.25	4,188.17	2,468	78,951	35	3,531

Table 1. System Operation Data Summary Sheet (Continued)

Date at end of Week	Approx Week*	Hours System Operation (hrs)	Cumulative System Operation (hrs)	Water Discharged Weekly (gal)	Water Discharged Cumulative	Fuel Recovery Weekly (gal)	Fuel Recovery Cumulative
09/02/93*	26	166.00	4,354.17	4,917	83,868	155	3,686
09/09/93	27	164.50	4,518.67	4,574	88,442	115	3,801
09/16/93	28	159.75	4,678.42	6,309	94,751	187	3,988
09/23/93	29	149.17	4,827.58	11,657	106,408	293	4,281
09/30/93	30	144.75	4,972.33	11,794	118,202	352	4,632
10/07/93	31	163.42	5,135.75	11,708	129,910	236	4,868
10/14/93	32	167.00	5,302.75	10,099	140,009	216	5,059
10/24/93	32	91.75	5,394.50	840	140,849	40	5,099
11/02/93	32	System Off	5,394.50		140,849		
11/11/93	33	188.00	5,582.50	6,671	147,520	23	5,203
11/18/93	34	144.00	5,726.50	5,665	153,185	58	5,261
11/24/93	35	168.00	5,894.50	5,458	158,643	119	5,380
11/28/93	35	No Servicing	5,894.50		158,643		
12/02/93	36	168.00	6,062.50	6,417	165,060	165	5,545
12/09/93	37	165.50	6,228.00	5,770	170,830	292	5,836
12/16/93	38	168.00	6,396.00	5,128	175,958	260	6,096
12/24/93	39	125.00	6,521.00	2,900	178,858	209	6,306
12/31/93	39	160.00	6,556.00	4,427	180,385	163	6,469

*Approx. weeks = Cumulative hrs/168 hrs

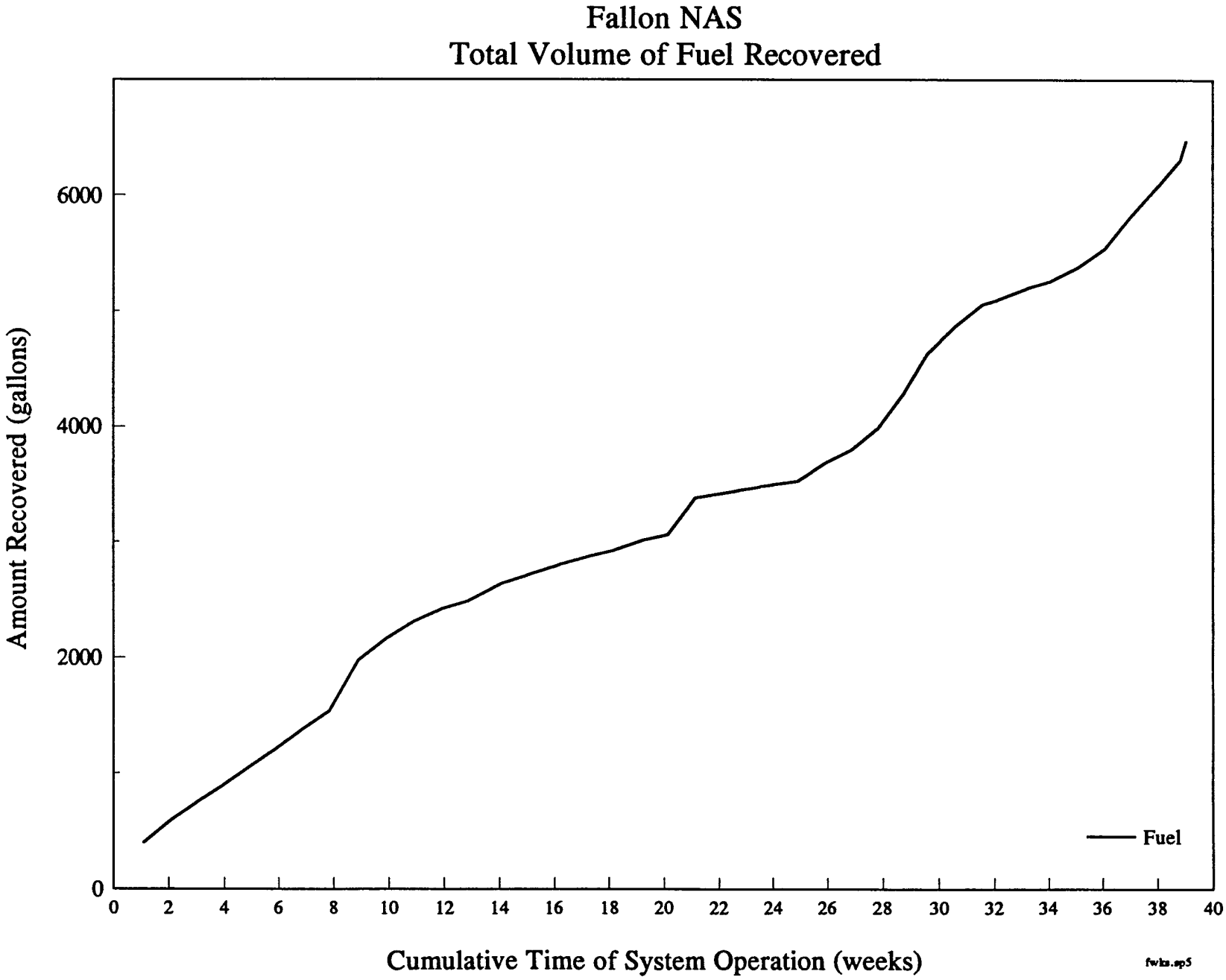

Figure 6. Cumulative Free-Product Recovery Data for the NAS Fallon Bioslurper System.

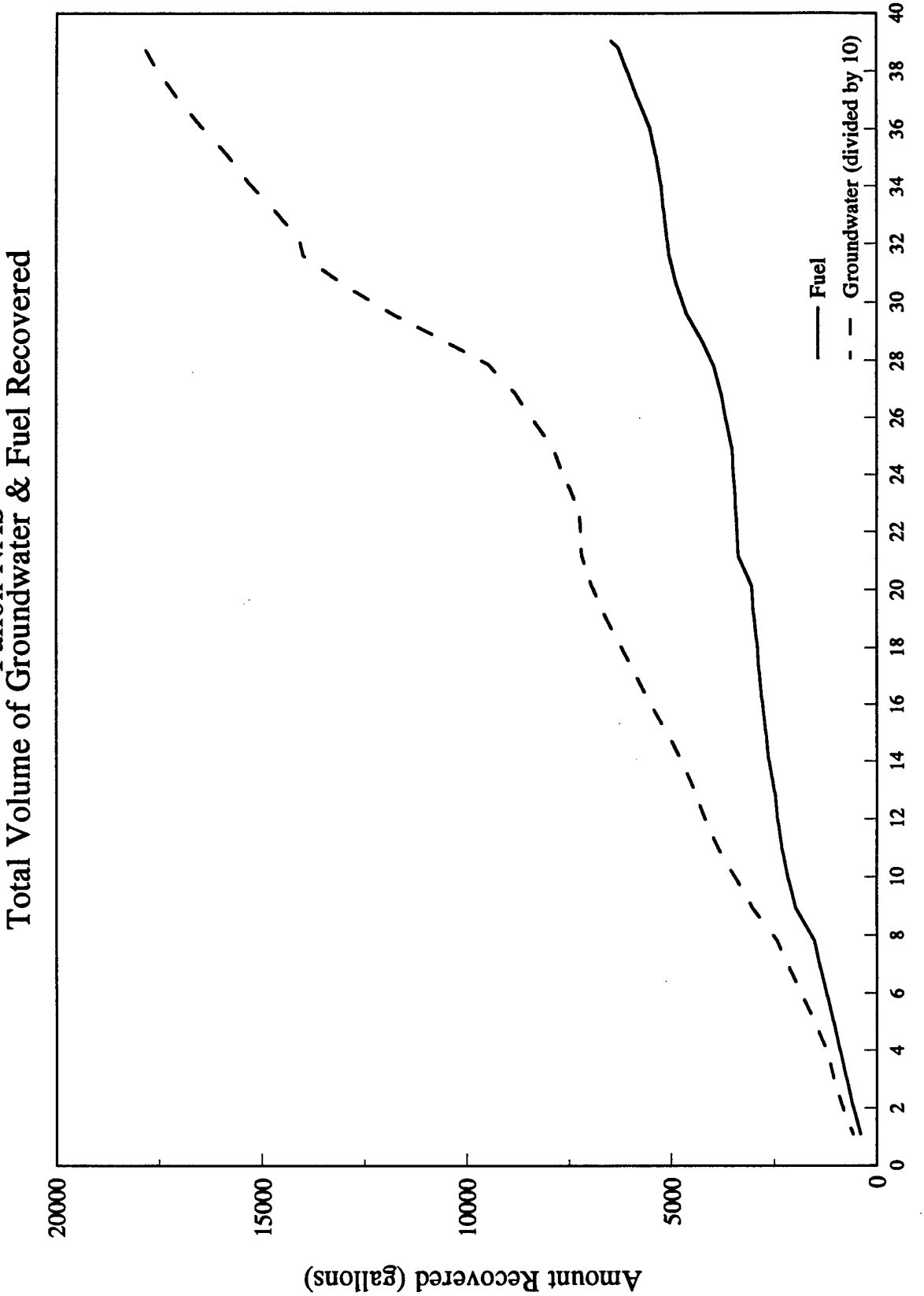

Figure 7. Cumulative Free-Product and Groundwater Extraction Volumes for NAS Fallon Bioslurper System.

year of operation. As the slopes of the two lines show, recovery rates have remained relatively constant through the first year of operation. A summary of system operation data is presented in Appendix B.

5.2.2 Aqueous Phase Hydrocarbons

The mass of hydrocarbons removed in the aqueous phase was estimated based on the total volume of groundwater extracted and the average concentration of total petroleum hydrocarbons (TPH) found in the monthly regulatory samples. As of December 31, 1993, a total of 180,385 gal of groundwater had been extracted, with an average flow rate of 0.46 gpm. A total of 10 groundwater discharge samples were analyzed for TPH concentration (as JP-5) to quantify mass of hydrocarbons removed in the aqueous phase. Concentration values ranged from 30 mg/L (ppm) to 200 mg/L, with an average concentration of 104 mg/L. Table 2 presents effluent discharge analytical results. The estimated mass of hydrocarbons removed in the aqueous phase for the first year of operation was 157 pounds (71 Kg), with an average rate of 0.58 lbs/day. Effluent sample analytical data is presented in Appendix C.

5.2.3 Gaseous Phase Hydrocarbons

The vapor discharge has been sampled several times to investigate the mass of hydrocarbons released to the atmosphere. An Air Discharge Performance Test was conducted as required under the NDEP Air Discharge Permit (Appendix A). The measured emission concentration from the bioslurper system was 1,300 mg/m^3. The average flow rate from the bioslurper vapor discharge has been 40.25 scfm, for a total of 15,622,635 ft^3 (438,046 m^3) soil gas extracted. The estimated mass of hydrocarbons discharged in the vapor phase for the first year of operation was 1,256 pounds (569 kg), for an average discharge rate of 4.66 lbs/day.

The total estimated mass of hydrocarbons removed from the NAS Fallon bioslurper test site during the first year of operation is 47,272 lbs. The percentage of mass removed in the liquid phase is 97.0%, dissolved phase 0.3%, and vapor phase 2.7%. Table 3 summarizes the NAS Fallon hydrocarbon recovery data.

Table 2. Results From Bioslurper Effluent Analyses for TPH and pH at Fallon NAS

Sample Name	TPH (mg/L)	pH
FNAS-E8	55	8.89
FNAS-E9	46	8.88
FNAS-E10	85	8.81
FNAS-E11	150	8.95
FNAS-E12	130	8.81
FNAS-E13	97	8.87
FNAS-E14	30	9.00
FNAS-E15	40	8.97
FNAS-E16	210	8.82
FNAS-E18	200	8.77

Table 3. Summary of Hydrocarbon Recovery Data for NAS Fallon Bioslurping System

Hydrocarbon Phase	Mass Removed (lbs)	Percent of Mass Removed
Liquid	45,859	97%
Aqueous	157	0.3%
Vapor	1,256	2.7%
Total	47,272	100%

5.3 Groundwater and Product Level Measurements

Groundwater elevation data and free-product apparent thickness measurements were taken in the site monitoring wells weekly and in the bioslurper extraction wells quarterly. Liquid level measurements were taken using an oil/water interface probe (ORS, Norwood, MA). The site map presented in Figure 8 shows the locations of the site monitoring wells and the site bioslurper wells. Monitoring wells are identified as MW-A, MW-B, MW-C, MW-D, and MW-E. MW-D is the site background monitoring well located 110 ft east of MW-C. Figures 9 through 13 present the hydrographs for site monitoring wells A through E. MW-F and MW-G were installed as passive vent wells and may not be adequately constructed for use as site monitoring wells. The data presented for these wells should be considered accordingly. Groundwater and free-product level data for the site monitoring wells are presented in Appendix D.

As the graphs indicate, depth to groundwater has decreased gradually during the course of the study and is likely the result of the increased rainfall and irrigation experienced in 1993. Thickness of the free product apparent in each site monitoring well has decreased as the water table has risen and as free product has been removed. Monitoring well MW-E is in the center of the test site and is probably the only site well completely influenced by the pumping system, as indicated by the wide fluctuations in fuel and groundwater measurements.

The bioslurper system is shut down quarterly to take fuel/groundwater level measurements and to reposition the slurper tubes to account for changes in depth to groundwater. Hydrographs for bioslurper wells 19 through 24 are presented in Figure 14. Hydrographs for the remaining wells and the depth to groundwater and product thickness data for each is presented in Appendix E.

The groundwater/product interface data indicate a general decrease in apparent product thickness. However, as the data for the background monitoring well shows, the groundwater

NAS Fallon Site Diagram

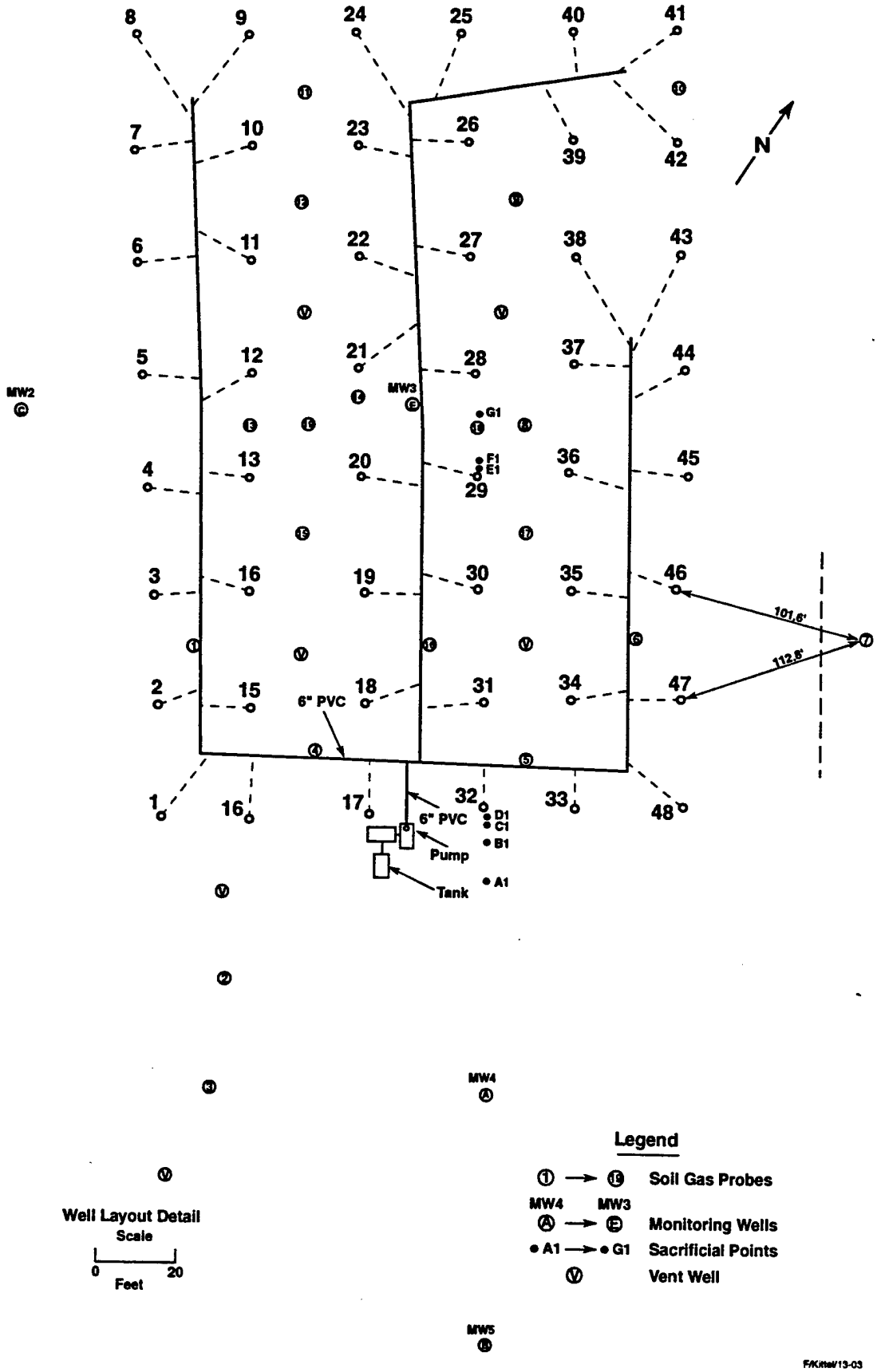

Figure 8. **Bioslurper Test Site Well and Soil Gas Monitoring Point Location Map. (Note: MW-D is located 110 ft Northwest of MW-C)**

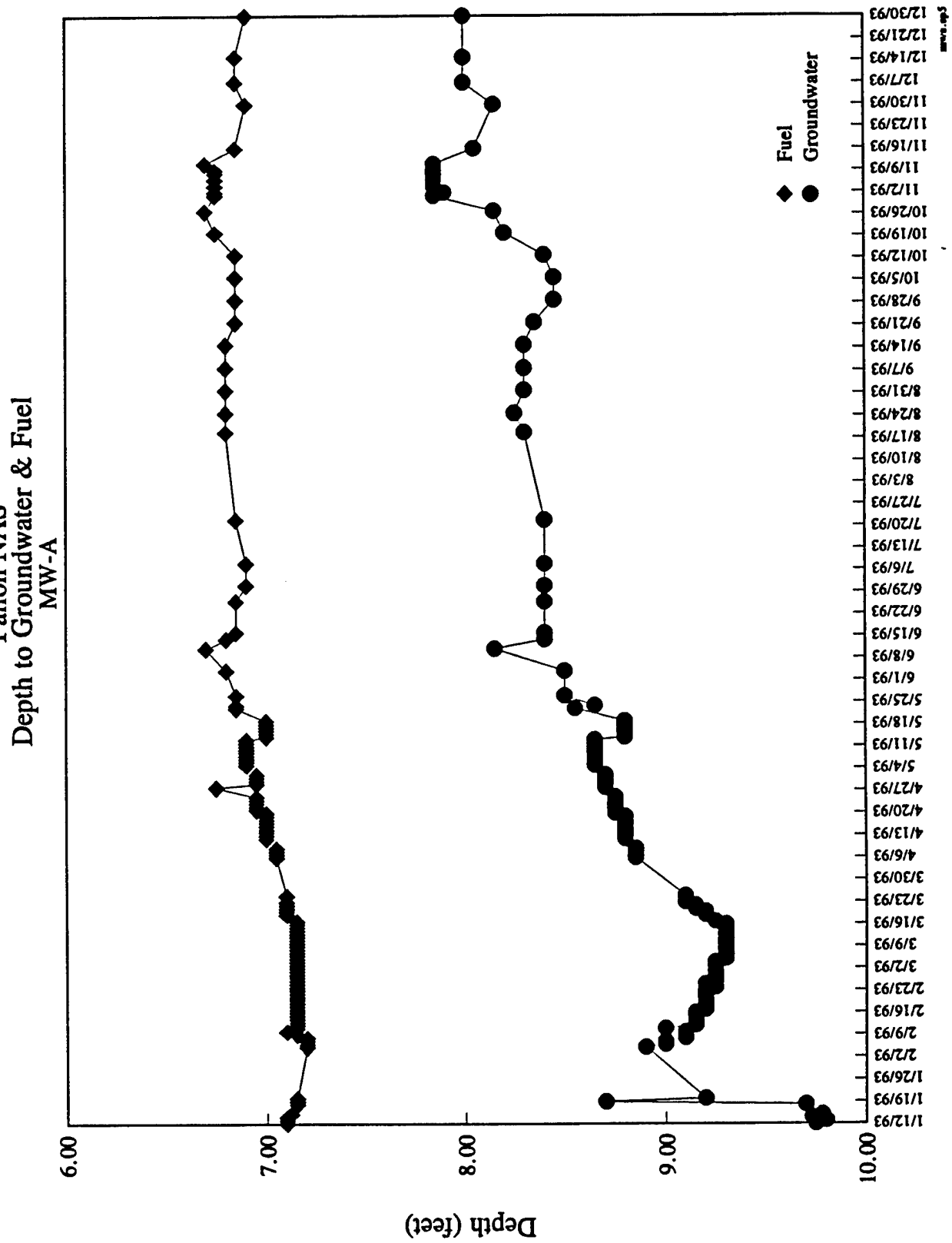

Figure 9. Hydrograph for Monitoring Well MWA. (Refer to Figure 8 for well location)

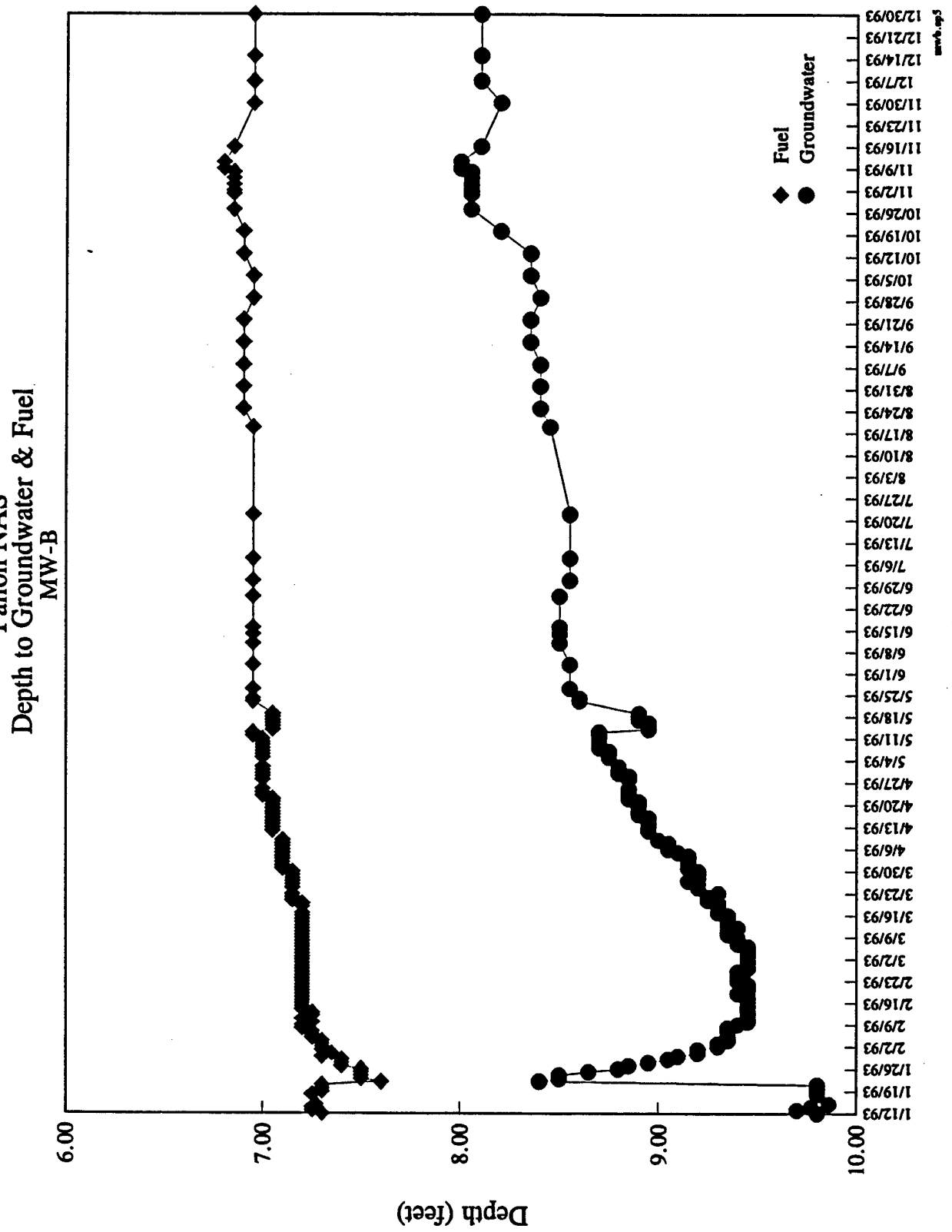

Figure 10. Hydrograph for Monitoring Well MW-B. (Refer to Figure 8 for well location)

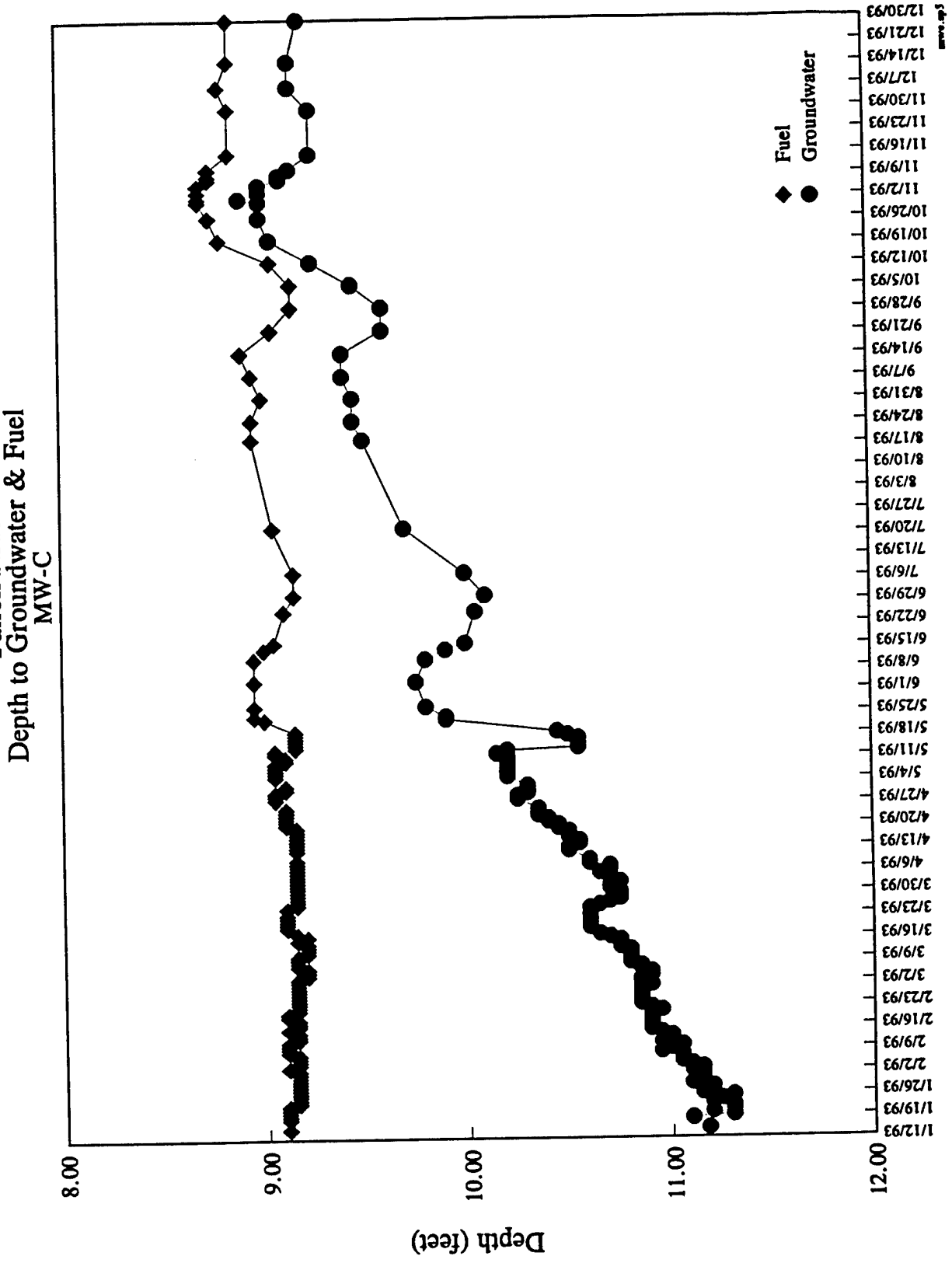

Figure 11. Hydrograph for Monitoring Well MW-C. (Refer to Figure 8 for well location)

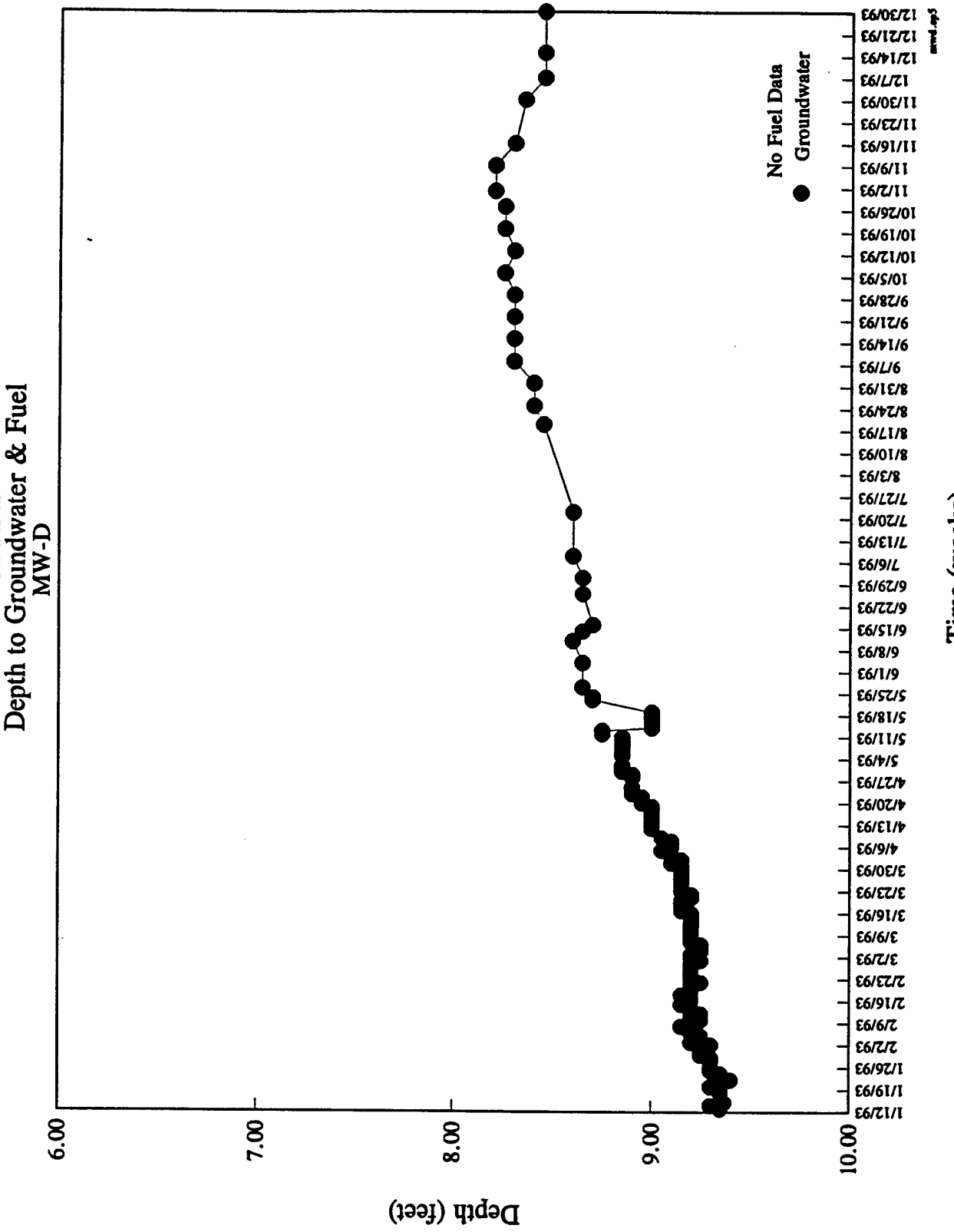

Figure 12. Hydrograph for Monitoring Well MW-D Background Well. (Refer to Figure 8 for well location)

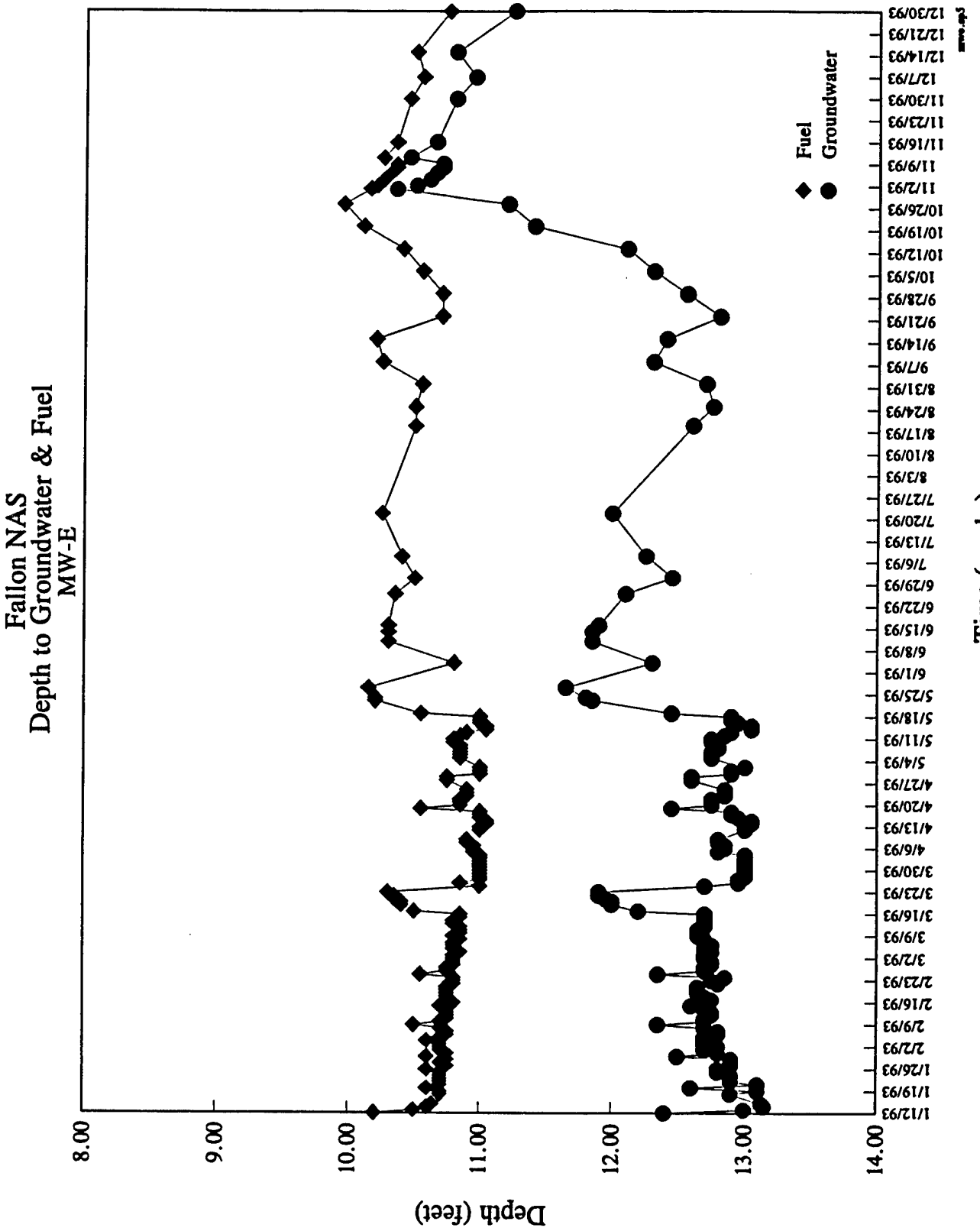

Figure 13. Hydrograph for Monitoring Well MW-E. (Refer to Figure 8 for well location)

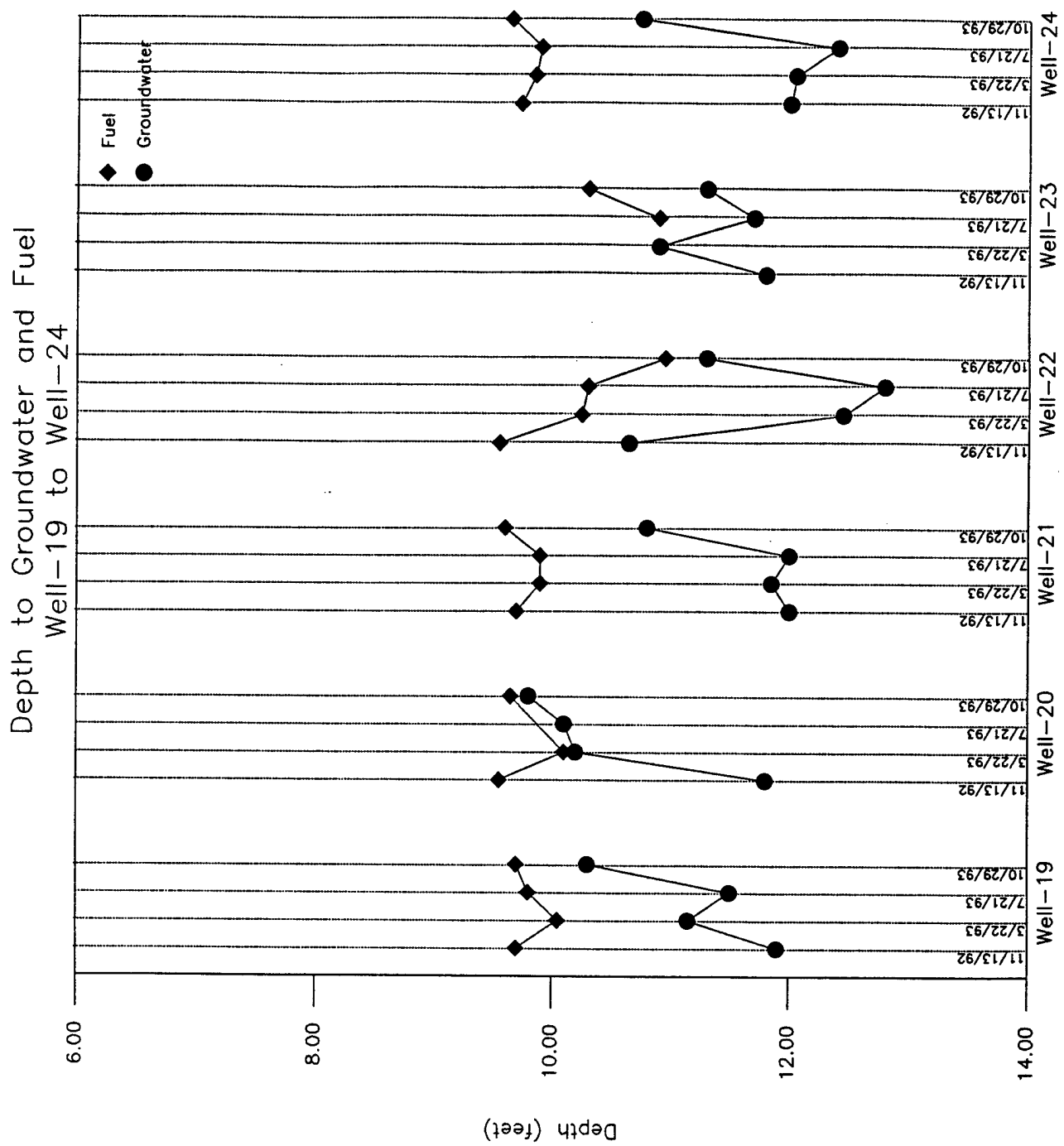

Figure 14. Hydrograph for Bioslurper Extraction Wells #19 through #24. (Refer to Figure 8 for well location)

table has risen and product entrapment below the water table is a possibility. It is not possible to determine whether the apparent decrease in product thickness is related to entrapment or recovery of free-product or both.

5.4 Soil Gas Field Analysis

A total of 21 three-level soil gas monitoring points have been installed at the bioslurper test site and in the background area. All monitoring points were installed using hand-advanced bucket augers to just above the water table. Each monitoring point consists of three ¼-inch nylon tubes, each with a 6-inch screened interval. Each borehole was screened at three depths: 2.5 ft below groundsurface, 6.5 ft (just below a thin clayey layer), and just above the saturated zone. Figure 15 shows a typical construction diagram for a soil gas monitoring point. Refer to Figure 8 for soil gas monitoring point locations on the bioslurper test site.

Soil gas analysis was conducted using the procedures outlined in Hinchee et al (1992). Samples were analyzed for CO_2, O_2, and total petroleum hydrocarbon concentration using the Gastech Model 32520X CO_2/O_2 analyzer and the Gastech Trace-Techtor hydrocarbon analyzer. Soil gas samples were collected weekly at first and then less frequently as it was apparent that soil gas concentrations on the site were relatively static. Soil gas data for all the monitoring points are presented in Appendix D.

Soil gas data indicate that, unlike the original site considered for the NAS Fallon bioslurper pilot study (Hinchee et al, 1991), the subsurface at the bioslurper test site is not oxygen-limited. Soil gas concentrations all depths across the site at exhibit relatively high oxygen concentrations and low carbon dioxide concentrations. Biodegradation of fuel hydrocarbons is considered oxygen-limited at O_2 concentrations significantly below 5%. The majority of site soil gas monitoring points exhibit O_2 concentrations of over 18%, with the lowest O_2 concentration being at MP-10C with approximately 8%. Conversely, MP-7, which was installed adjacent to the NAS Fallon fuel farm, exhibits soil gas O_2 concentrations near 1.0%. MP-7 also exhibits soil gas hydrocarbon concentrations 500 to 1000 ppm higher than those observed on the bioslurper test site.

5.4.1 In Situ Respiration Tests

The in situ respiration test method was explained in the previous project report (Battelle, 1992) and is explained in detail in Hinchee, et al. (1992). As explained in this earlier report, the test site selected for the bioslurper system was changed at the request of the Environmental

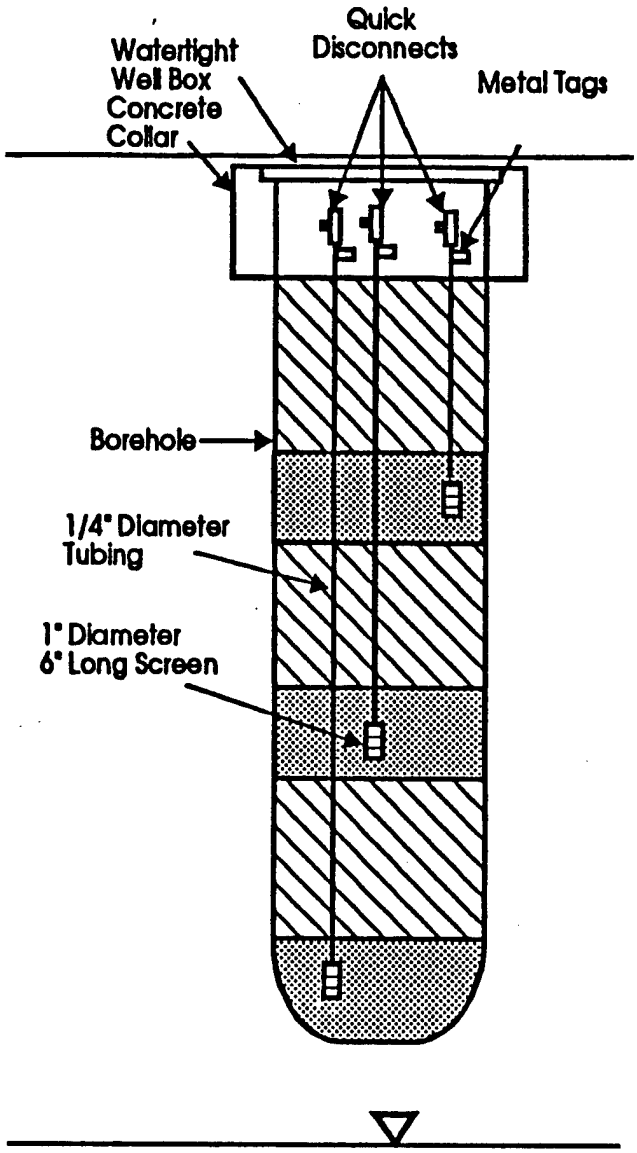

Figure 15. Typical Construction Diagram for a Soil Gas Monitoring Point.

Department at NAS Fallon. There was concern that Battelle's project activities would interfere with remedial activities being planned by the base environmental contractor. The result was that the bioslurper system was moved from a site at the base fuel farm complex where relatively high biodegradation rates had been observed (Hinchee et al, 1991), to a site that had not been evaluated for in situ biodegradation. However, because the site had a great deal of free product, it was deemed a good site for conducting the bioslurper pilot demonstration.

An in situ respiration test was conducted at the NAS Fallon Bioslurper site in November 1992. As explained in the previous section, the soil gas characteristics observed from most monitoring points at the bioslurper test site were not oxygen-limited. The respiration test was conducted at MP-7b and MP-7c, where oxygen-limited conditions did exist, at MP-10c where oxygen concentration was somewhat depressed, and at the background monitoring point. Air with 1 to 2% helium was injected in each selected monitoring point. After 24 hours, the air injection was stopped and soil gas was sampled periodically to monitor O_2 utilization, CO_2 production, helium concentration, and TPH concentration. The test was terminated after 91 hours when soil gas readings had stabilized. The data from the in situ respiration test is presented in Table 4.

The O_2, CO_2, and helium data from each monitoring point was plotted versus time to determine rates (percent/day) of oxygen utilization and carbon dioxide production. Helium was monitored as a conservative tracer for diffusion or leakage from the soil gas monitoring point. The graphs for each monitoring point are shown in Figures 16 through 19. Oxygen utilization rates for MP-7b and MP-7c were 8.0%/day and 11.1%/day, respectively. The oxygen utilization rate observed at MP-10c was 2.3%/day. The background monitoring point showed no significant oxygen utilization, indicating that background natural oxygen demand was negligible. Helium concentrations decreased during the test at all monitoring points, but did not indicate that diffusion or leakage was significant at any monitoring point. Carbon dioxide concentrations changed very little during the respiration test. This likely is due to carbonate formation in the high pH soils at NAS Fallon and is the reason that oxygen utilization is a more reliable indicator of biodegradation at most sites.

To relate respiration rates and resulting biodegradation rates with active bioventing measurements and other sites in the literature, a stoichiometric relationship for fuel oxidation is required. Hexane (C_6H_{14}) is used as the representative hydrocarbon for the jet fuel for the purpose of comparing the CO_2 and O_2 rates. The stoichiometric relationship is given by:

$$C_6H_{14} + 9.5\ O_2 \rightarrow 6CO_2 + 7H_2O \qquad (1)$$

Table 4. Fallon NAS Respiration Test 11/16/92 to 11/20/92

Time (hrs)	Background				MP-10c				MP-7b				MP-7c			
	O_2	CO_2	TPH	He	O_2	CO_2	TPH	He	O_2	CO_2	TPH	He	O_2	CO_2	TPH	He
0	21	0.3	0	2.5	21	0.3	40	--	21	0.3	0	1.5	21	0.3	18	1.5
2	21	0.3	0	1.9	21	0.3	10	--	20	0.4	25	1.1	15.5	0.8	--	1.1
4	20.5	0.4	8	2.5	20.5	0.7	34	--	18.5	0.5	14	1.3	12	0.8	--	1.1
6	20.5	0.6	35	2.2	20.5	0.6	60	--	17.5	0.6	35	1.1	11.5	0.9	1700	1.1
8	20.5	0.5	10	2.5	20	0.5	55	--	16.5	0.6	--	1	10	0.6	--	1.2
10	20.5	0.4	0	2.4	20	0.4	20	--	15.5	0.5	25	1	8	0.6	640	1.1
12	20.5	0.5	18	2.3	20	0.5	78	--	15	0.4	15	0.9	8	0.5	1000	1.3
16	20.5	0.5	--	2.3	19	0.6	84	--	13.5	0.7	12	0.93	7	0.8	1100	1.3
21.5	20.5	0.5	16	2.2	18	0.6	50	--	12	0.5	24	0.91	6.5	0.8	1300	1
27	20	0.5	40	1.8	18	0.5	100	--	10	0.5	60	0.88	3.5	0.6	1600	0.79
32	21	0.8	40	1.6	18	1	90	--	9	1	54	0.74	2	1	1700	1.1
44.5	20.5	0.7	20	1	17	0.5	50	--	6	0.5	20	0.66	1	0.6	1600	0.95
54.5	21	0.7	40	0.72	15	0.6	86	--	6.5	0.8	85	0.5	1	0.8	1400	0.77
68.5	21	0.7	--	0.63	14.5	0.8	--	--	6.5	0.8	--	0.38	--	--	--	--
91.5	21	0.8	57	0	12.5	0.7	38	--	5.5	0.7	90	0.26	--	--	--	--

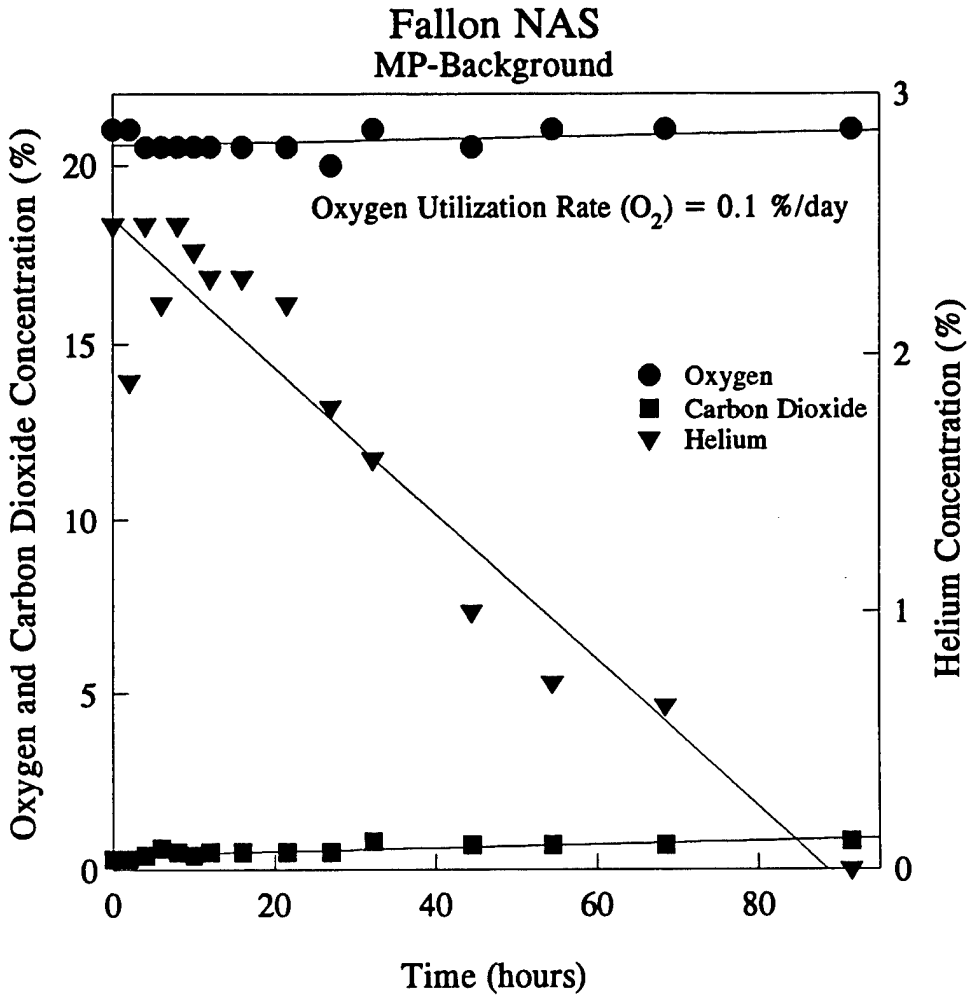

Figure 16. Plot of In Situ Respiration Data for the Background Monitoring Point.

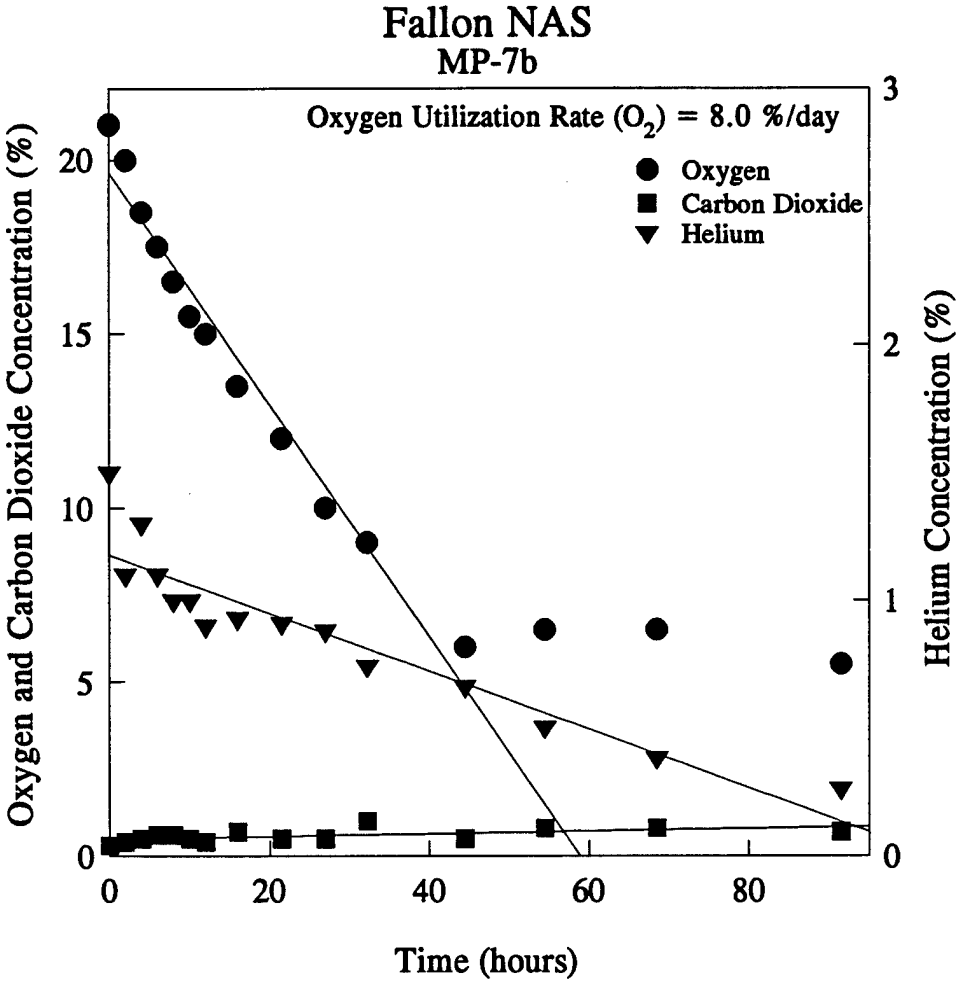

Figure 17. Plot of In Situ Respiration Test Data for MP7-b.

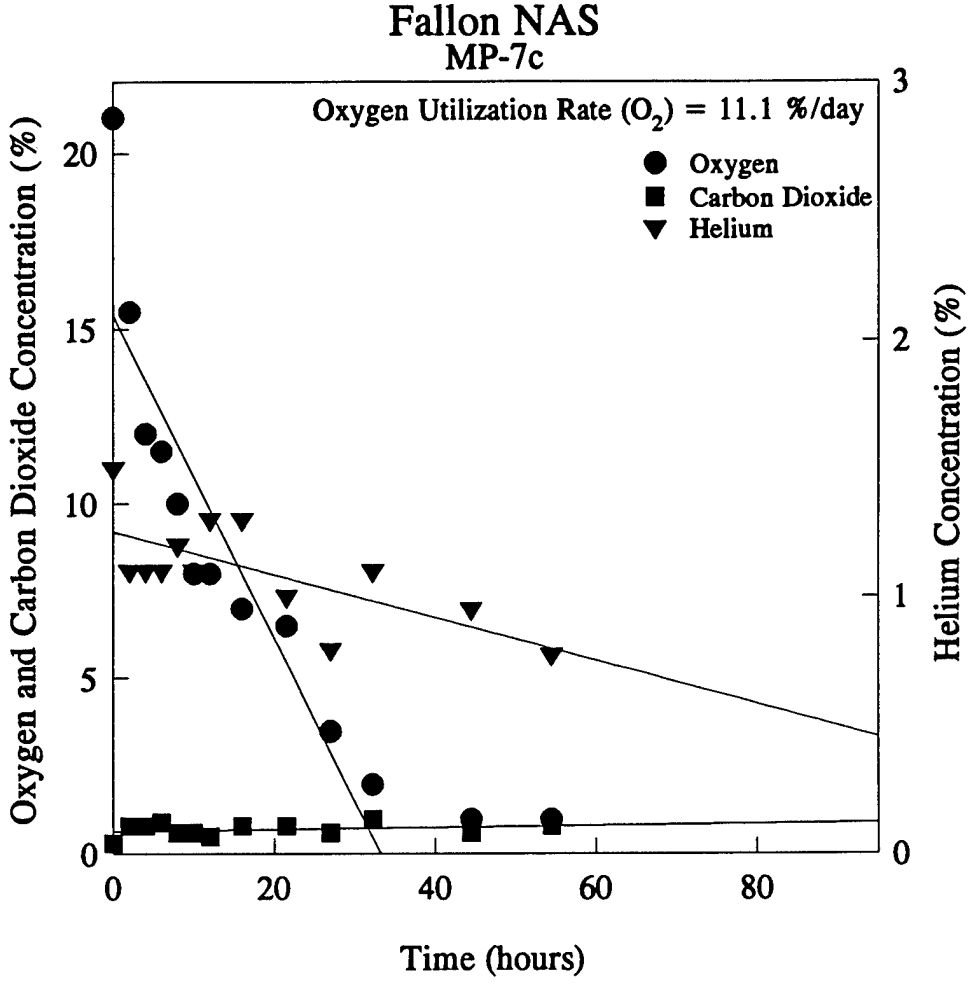

Figure 18. Plot of In Situ Respiration Data for MP7-c.

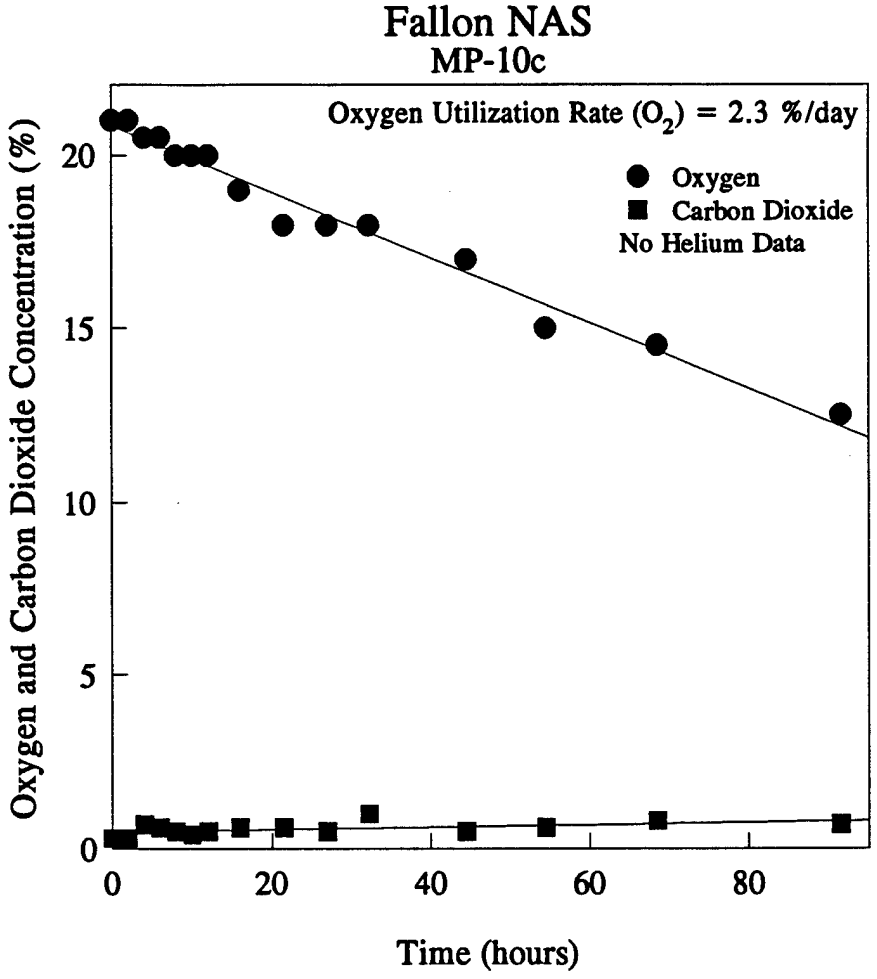

Figure 19. Plot of In Situ Respiration Data for MP-10c.

Based on oxygen utilization rates (percent/day), biodegradation rates in terms of mg/kg/day are computed by assuming a soil bulk density of 1,440 kg/m^3 and a porosity of 0.30 using the following equation:

$$K\beta = -K_o\, AD_oC \times 1/100\% \times 24 \text{ hr/day} \qquad (2)$$

where:

$K\beta$ = biodegradation rate (mg/kg/day)

K_o = oxygen utilization rate (%/hr)

A = volume of air/kg of soil (1/kg) in this case 300/1,440 = 0.21

D_o = density of oxygen gas (mg/L), assumed to be 1,330 mg/L

C = mass ratio of hydrocarbon to oxygen required for mineralization, assumed to be 1/3.5 from equation (1) above.

The biodegradation rates calculated for MP-7b and MP-7c were 6.4 and 8.88 mg/kg/day, respectively. The calculated degradation rate for MP-10c was 1.84 mg/kg/day. The results from the in situ respiration test are presented in Table 5.

Table 5. Biodegradation Rates During the Respiration Test: November 16 to November 20,

Monitoring Point	Oxygen Utilization Rate	Biodegradation Rate
MP-Background	0.1	0.08
MP-7b	8.0	6.4
MP-7c	11.1	8.88
MP-10c	2.3	1.84

5.5 Soil Sample Chemical Data

Soil sampling was conducted twice at the bioslurper test site during 1993. Samples were collected from the background site, the bioslurper test site, and the adjacent NAS Fallon fuel farm (adjacent to soil gas MP-7) on July 21, 1993. Samples were analyzed for TPH (purgeable), BTEX, Alkalinity, Nitrate-N, TKN, TP, Chloride, Sulfate, Arsenic, Sodium, Calcium, Magnesium, Iron,

pH, and moisture content. Sampling was conducted a second time on November 2, 1993, from the approximate same locations sampled in July. Samples were analyzed for TPH (quantified in the Diesel range), TRPH (infrared method), BTEX, Alkalinity, Nitrate-N, Nitrite-N, TOC, TKN, TP, Arsenic, Lead, CEC, pH, Exchangeable Ammonium-N, Exchangeable Iron, and particle size distribution. Analytical results for the two sampling events are presented in Tables 6 through 9.

The analytical results from the background, the bioslurper test site, and the fuel farm were compared to identify a chemical or physical difference between the fuel farm and the bioslurper test site that could account for the observed differences in soil gas biodegradation indicators (oxygen limitation). The only apparent difference between the two areas is the composition of the subsurface contamination. The contamination at the bioslurper test site is predominated by JP-5 contaminants with very low concentrations of the BTEX range hydrocarbons. The soil samples from the fuel farm area show much higher BTEX range hydrocarbons, indicating gasoline range contaminants. These data support previous site investigations at the fuel farm area, which indicated MOGAS contaminant plumes along with JP-5 contamination (ORNL, 1991).

Table 6. Results of Soil Data Analyses for BTEX and TPH Data from Fallon NAS Bioslurper Site, July 21, 1993.

Sample Name	Benzene (mg/kg)	Toluene (mg/kg)	Ethyl-benzene (mg/kg)	Total Xylenes (mg/kg)	TPH (purgeable) (mg/kg)
7-21-BK-2-3′	ND	ND	ND	ND	ND
7-21-BK-5-6′	ND	ND	ND	ND	ND
7-21-BK-7-8′	ND	ND	ND	ND	ND
7-21-TS-2-3′	ND	ND	ND	ND	ND
7-21-TS-5-6′	ND	ND	ND	ND	ND
7-21-TS-9-10′	ND	ND	ND	0.51	180*
7-21-FF-2-3′	ND	ND	ND	ND	ND
7-21-FF-6-7.5′	0.87	0.99	10	53	17,000**

ND not detected

* Hydrocarbons in the range of: C9-C10=11%; C11=20%; C12=33%; C13=24%; C14=11%

** Hydrocarbons in the range of: C7 to C9=5%; C10=8%; C11=21%; C12=33%; C13=26%; C14=7%

Table 7. Results of Soil Chemistry Analyses for Data from Fallon NAS Bioslurper Site, July 21, 1993.

Parameter	Sample Name			
	TS-5-6′	TS-9-10′	FF-2-3′	FF-6-7.5′
pH_{SP}	9.38	9.19	7.98	9.07
Alkalinity (mg/kg as $CaCO_3$)	23,000	6,100	4,150	6,840
Nitrate - Nitrogen (mg/kg)	< 8	< 7	17	< 7
Total Kjeldahl Nitrogen (mg/kg)	113	49	89	87
Total Phosphorus (mg/kg)	1,470	919	385	1,140
Chloride (mg/kg)	1,380	662	1,950	1,960
Sulfate (mg/kg)	1,600	986	1,870	2,110
Arsenic (mg/kg)	28	9.9	13	11
Sodium (mg/kg)	3,000	1,480	2,370	2,930
Calcium (mg/kg)	18	9.9	35	4.1
Magnesium (mg/kg)	1.3	1.2	12	3.9
Iron (mg/kg)	23,530	14,290	23,170	25,000
Moisture (%)	32	23	18	24

Table 7. Results of Soil Chemistry Analyses for Data from Fallon NAS Bioslurper Site, July 21, 1993. (Continued)

Parameter	Sample Name			
	BK-2-3′	BK-5-6′	BK-7-8′	TS-2-3′
pH_{SP}	8.40	8.72	9.37	8.28
Alkalinity (mg/kg as $CaCO_3$)	2,690	6,150	6,340	8,290
Nitrate - Nitrogen (mg/kg)	< 7	< 7	< 7	< 7
Total Kjeldahl Nitrogen (mg/kg)	114	77	70	148
Total Phosphorus (mg/kg)	1,160	882	720	1,260
Chloride (mg/kg)	3,180	971	1,290	4,500
Sulfate (mg/kg)	9,710	2,210	2,730	3,450
Arsenic (mg/kg)	9.6	11	22	18
Sodium (mg/kg)	7,910	1,920	2,650	4,930
Calcium (mg/kg)	667	9.9	6.2	43
Magnesium (mg/kg)	24	1.4	2.2	15
Iron (mg/kg)	24,360	16,480	14,630	24,390
Moisture (%)	22	9	18	18

Table 8. Results of Soil Analyses for BTEX and TPH for Data from Fallon NAS Bioslurper Site, November 2, 1993

Sample Name	Benzene (mg/kg)	Toluene (mg/kg)	Ethyl-benzene (mg/kg)	m- & p-Xylenes (mg/kg)	o- Xylenes (mg/kg)	TPH/ Diesel (mg/kg)	TRPH (mg/kg)
TS1NOV2-2'-3'	0.0029	0.0058	0.0025	< 0.0025	< 0.0012	< 10	< 10
TS1NOV2-5'-6'	< 0.0012	0.0038	< 0.0012	< 0.0023	< 0.0012	< 10	< 10
TS1NOV2-8'-9'	< 0.62	0.69	0.77	1.3	3.5	8800	4400
TS2NOV2-3'-4'	< 0.0011	0.0091	< 0.0011	< 0.0022	< 0.0011	< 10	70
TS2NOV2-6'-7'	< 0.0013	0.011	< 0.0013	< 0.0026	<0.0013	< 10	110
TS2NOV2-8'-9'	< 0.62	1.8	< 0.62	< 1.2	2.9	7000	3900
BKNOV2-2'-3'	< 0.0011	0.0045	< 0.0011	< 0.0022	< 0.0011	< 10	37
BKNOV2-5'-6'	< 0.0011	0.0041	< 0.0011	< 0.0023	< 0.0011	< 10	80
BKNOV2-7'-8'	< 0.0014	0.011	< 0.0014	< 0.0028	< 0.0014	< 10	46
FFNOV2-2'-3'	< 0.0012	0.0045	< 0.0012	< 0.0025	< 0.0012	< 10	65
FFNOV2-6'-7'	< 0.64	1.9	2.4	9.7	7.3	5800	4300

Table 9. Results of Soil Chemistry Analyses for Data from Fallon NAS Bioslurper Site, November 2, 1993.

Parameter	Sample Name		
	TS1NOV2-2'-3'	TS1NOV2-5'-6'	TS1NOV2-8'-9'
Alkalinity (mg/kg)	680	3350	2730
Arsenic (ppm)	20.1	32.5	19.7
Lead (ppm)	4.9	9.7	8.1
Nitrate - N (mg/kg)	2.39	2.32	1.79
Nitrite - N (mg/kg)	< 0.20	< 0.20	< 0.20
Total Organic Carbon (ppm)	1290	577	609
Total Kjeldahl Nitrogen (mg/kg)	520	240	280
Total Phosphorus (mg/kg)	0.575	0.788	1.33
pH	8.26	9.65	9.39
Cation Exchange Capacity (meq/100g)	24.34	17.82	19.01
Exchangeable Ammonium-Nitrogen (ppm)	< 3	< 3	< 3
Exchangeable Iron (ppm)	< 1	< 1	< 1
Particle Size (%)	Sand: 63	Sand: 51	Sand: 41
	Silt: 20	Silt: 30	Silt: 38
	Clay: 17	Clay: 19	Clay: 21

Table 9. Results of Soil Chemistry Analyses for Data from Fallon NAS Bioslurper Site, November 2, 1993 (Continued)

Parameter	Sample Name		
	TS2NOV2-3'-4'	TS2NOV2-6'-7'	TS2NOV2-8'-9'
Alkalinity (mg/kg)	547	656	1840
Arsenic (ppm)	2.9	21.2	23.7
Lead (ppm)	4.3	10.4	7.7
Nitrate - N (mg/kg)	< 1.06	1.51	< 1.23
Nitrite - N (mg/kg)	< 0.20	< 0.20	< 0.20
Total Organic Carbon (ppm)	494	946	765
Total Kjeldahl Nitrogen (mg/kg)	120	160	140
Total Phosphorus (mg/kg)	0.580	0.717	1.39
pH	8.64	8.34	9.28
Cation Exchange Capacity (meq/100g)	9.4	23.33	19.22
Exchangeable Ammonium-Nitrogen (ppm)	< 3	< 3	< 3
Exchangeable Iron (ppm)	< 1	< 1	< 1
Particle Size (%)	Sand: 75	Sand: 35	Sand: 35
	Silt: 12	Silt: 40	Silt: 46
	Clay: 13	Clay: 25	Clay: 19

Table 9. Results of Soil chemistry Analyses for Data from Fallon NAS Bioslurper Site, November 2, 1993 (Continued)

Parameter	Sample Name				
	BKNOV2-2'-3'	BKNOV2-5'-6'	BKNOV2-7'-8'	FFNOV2-2'-3'	FFNOV2-6'-7'
Alkalinity (mg/kg)	1040	547	1670	494	1470
Arsenic (ppm)	3.6	26.3	64.2	14.1	17.4
Lead (ppm)	5.2	5.7	12.2	9.7	7.9
Nitrate - N (mg/kg)	< 1.12	< 1.15	< 1.33	8.36	2.1
Nitrite - N (mg/kg)	< 0.20	< 0.20	< 0.20	< 0.20	0.251
Total Organic Carbon (ppm)	428	405	1150	1110	1050
Total Kjeldahl Nitrogen (mg/kg)	540	150	250	230	110
Total Phosphorus (mg/kg)	0.418	0.426	2.06	1.08	0.521
pH	9.14	8.95	9.03	8.34	9.14
Cation Exchange Capacity (meq/100g)	6.66	6.41	32.29	26.35	17.14
Exchangeable Ammonium-Nitrogen (ppm)	< 3	< 3	< 3	< 3	< 3
Exchangeable Iron (ppm)	< 1	< 1	not analyzed	< 1	< 1
Particle Size (%)	Sand: 71	Sand: 67	Sand: 17	Sand: 39	Sand: 37
	Silt: 16	Silt: 18	Silt: 56	Silt: 32	Silt: 42
	Clay: 13	Clay: 15	Clay: 27	Clay: 29	Clay: 21

6.0 DISCUSSION

6.1 Evaluation of Vacuum-Enhanced Recovery

The premise of vacuum-assisted free-product recovery is that the fuel recovery rate can be enhanced by inducing a gradient to the extraction wells via negative pressure. It follows that higher recovery rates should be achieved as system vacuum is increased. To investigate the relationship between recovery and vacuum, the system vacuum at the pump intake was recorded daily as part of the daily system maintenance check. This data was plotted versus daily fuel recovery volume, daily groundwater extraction volume, and daily ratio of the volume of fuel to groundwater recovered (Figures 20, 21, and 22, respectively). As figures 20 and 21 indicate, there is a visible positive correlation between increased vacuum and increased fuel and groundwater recovery rates. Figure 22 indicates that there may be an increase in the ratio of fuel to groundwater recovered, but the data are less convincing. It should be noted that vacuum readings were taken only once per day and may not have represented the average of the system vacuum during each daily recovery period. However, there are sufficient data points to reveal the general trend of the effect of vacuum on recovery rates.

The total system vacuum does not represent the vacuum being applied inside each well. The actual increase in hydraulic gradient to each well is equal to the vacuum that is translated to each well head and is affected by pressure drops in the system manifold and by the site soil permeability. System total vacuum has varied from 3.0 to 12.0 inches of **mercury** (3.4 to 13.6 ft of water). Measured well-head vacuums have ranged from 15 to 30 inches of **water** vacuum. A 24-inch water vacuum at the well head would provide an equivalent hydraulic gradient increase to a 24-inch groundwater depression in a well. In the future, the use of a continuous pressure monitoring system will be investigated to collect vacuum data from the manifold system and the well heads to better observe the relationship between fuel recovery and vacuum.

Based on the data collected to date, it is evident that free-product recovery efficiency is being improved by vacuum-enhanced pumping. To further increase FPR rates, a new liquid ring pump will be installed with higher vacuum and flow capabilities.

6.2 Evaluation of Bioventing

Significant in situ biodegradation of fuel hydrocarbons does not appear to be occurring at the NAS Fallon bioslurping site. It appears that some factor other than the availability of oxygen is limiting biodegradation. Biodegradation rates measured at MP-7, near the base fuel farm, are

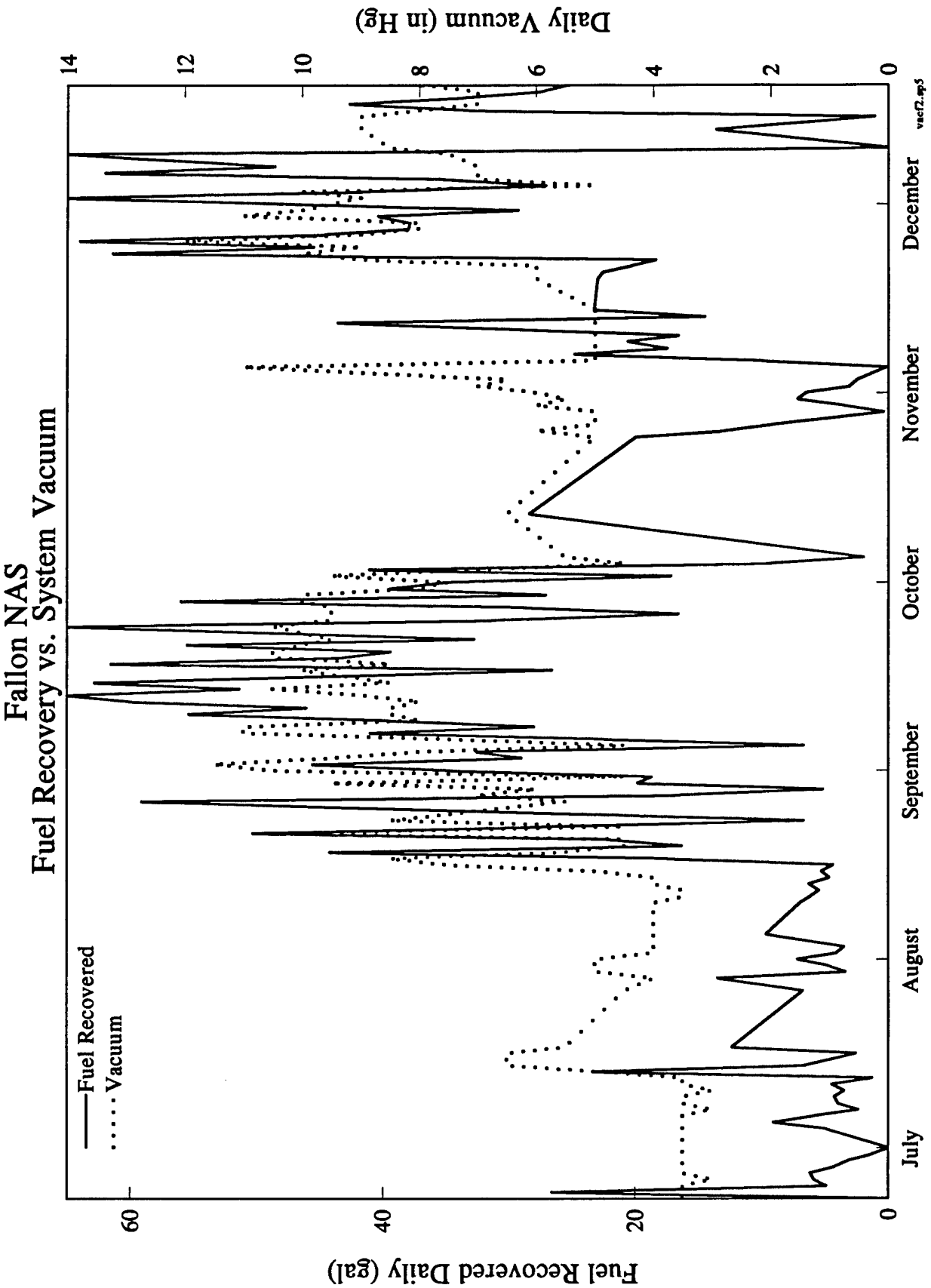

Figure 20. Graph of Bioslurper System Vacuum and Daily Free-Product Recovery.

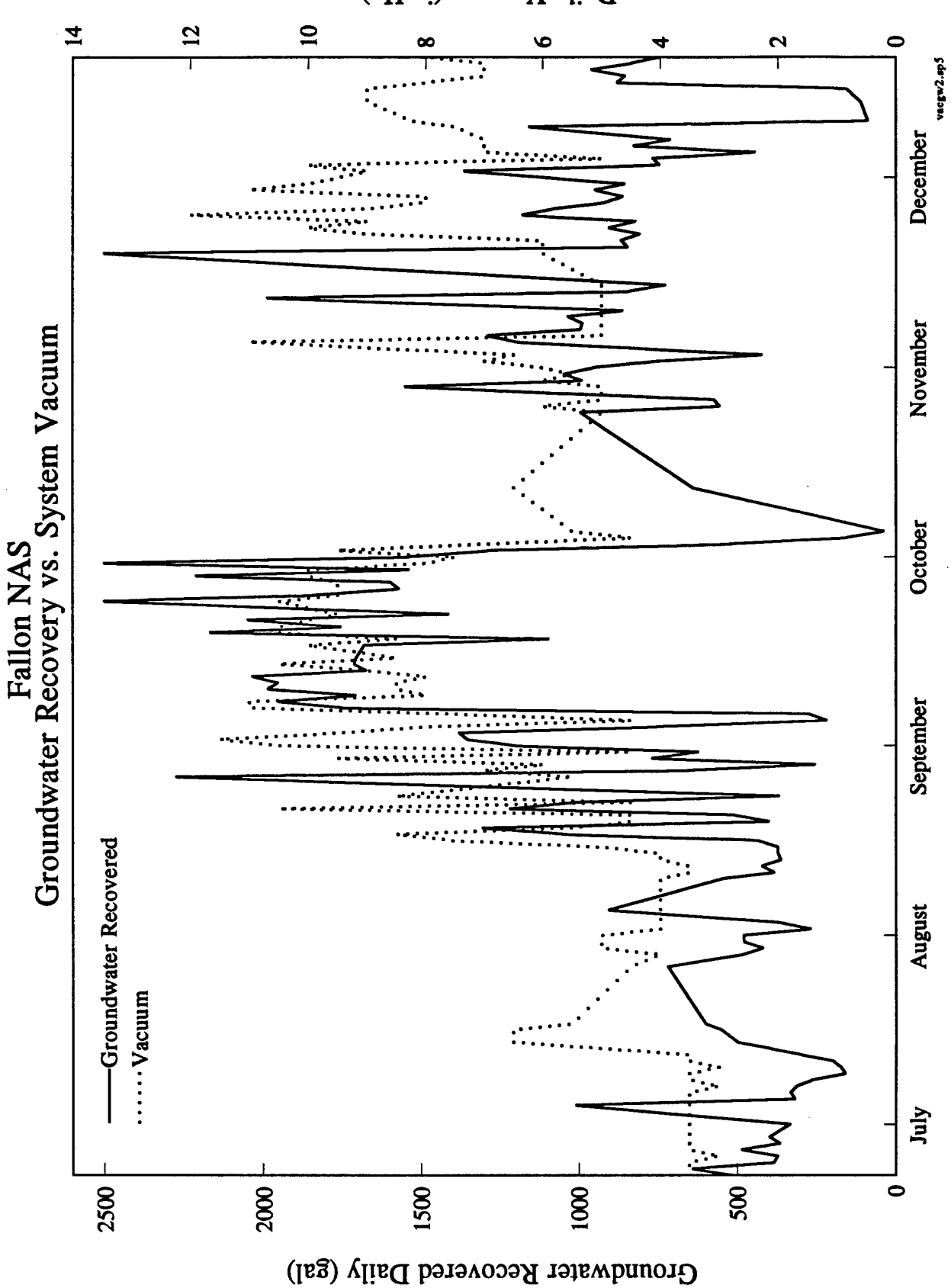

Figure 21. Graph of Bioslurper System Vacuum and Daily Groundwater Recovery.

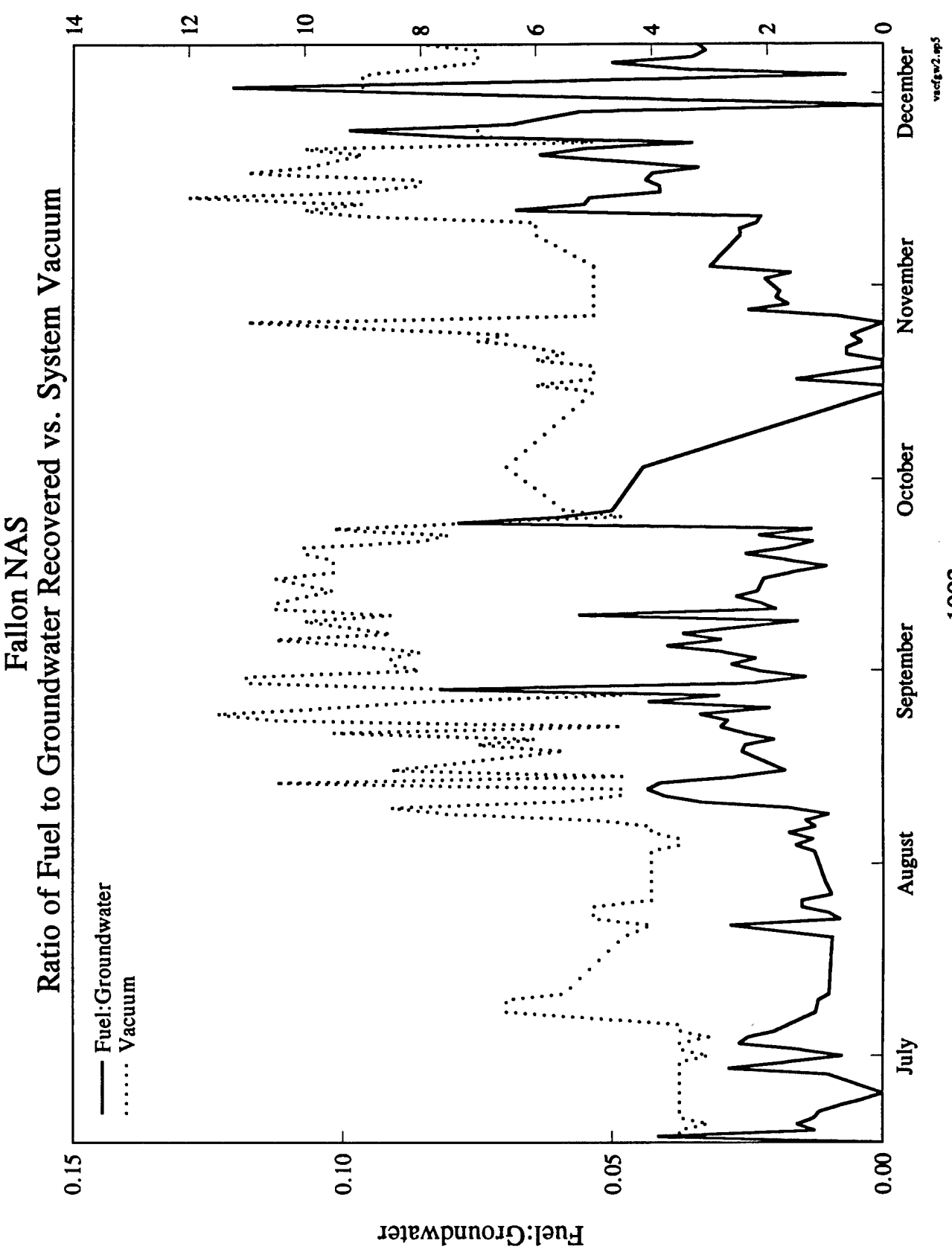

Figure 22. Graph of Bioslurper System Vacuum and the Ratio of Fuel Recovered to Groundwater Recovered.

relatively high, indicating that site soil conditions are conducive to natural in situ biodegradation. Soil sampling conducted to compare soil characteristics at the bioslurper site and the fuel farm indicate no apparent significant difference between the two sites.

Composition of the contaminants is quite different between the fuel farm area and the bioslurper test site. The contaminants at the fuel farm site exhibit much higher BTEX concentrations and volatile-range hydrocarbon concentrations than those at the test site. Site history for the two sites indicates that the only likely contaminant at the bioslurper site is JP-5, while the fuel farm site is known to have gasoline-range contaminants.

There are several possible causes of the difference seen in degradation rates at the fuel farm and the bioslurper test site. One important factor may be the age of the release. The NAS Fallon fuel farm has been active for more than ten years, and some level of contamination likely has been present at this site since fuel-handling activities began. The contamination at the bioslurper site is likely the result of a leak from the fuel-supply pipeline that transports JP-5 (recently switched to JP-8) to the fuel farm. It is possible that this release is much more recent, and the site microbial population has not been able to equilibrate to the release. Another possible factor affecting biodegradation at the bioslurper site is the presence of a bacterial inhibitor in the JP-5. The pipeline company that supplies the jet fuel adds a corrosion inhibitor to the fuel, and this may be inhibiting microbial activity at the site.

The data collected at the site to date would suggest that the most obvious cause of the differences in the observed biodegradation rates is the composition of the contamination. Because contaminant composition is the only obvious difference between the two sites it was decided to perform an in situ respiration test at another site contaminated exclusively with JP-5 jet fuel. The site chosen was the fuel farm at Marine Corps Air Station (MCAS) Kaneohe Bay, Hawaii.

6.3 MCAS Kaneohe Bay

The site is located on the Mokapu peninsula surrounded by embayments in a tropical setting with very uniform seasonal temperatures. The contaminant plume is exclusively JP-5 jet fuel, and it covers an area of nearly 5 acres (2 hectares) around a previously leaking very large above-ground tank. The subsurface soil profile consists of sand, silt and clay originating from basalts, volcanic tuff, and coral limestone. The upper section consists predominantly of silty reddish brown sand 0.3 to 4.5 meters thick. This is underlain by a cohesive sandy clay zone which extends to about 6 meters, at the groundwater table. Highly permeable sand and silty sand is encountered below the groundwater table to about 10 meters, where sandy clay and calcareous fines are encountered as the possible aquatard.

The fuel appears to reside in both the low-permeability zone above and the high-permeability zone just below the water table. The groundwater appears to be fresh and not affected by tides.

During previous investigations conducted by the Navy, nearly 100 soil borings were emplaced at the field site to delineate the extent of the free-product plume. Soil gas monitoring points were installed in August 1993, and soil samples were collected from three borings for chemical analysis. In situ respirometry was performed after the monitoring points were installed.

The in situ respiration test at Kaneohe MCAS was performed in the summer of 1993. Two sequential respiration tests were performed. The first test was performed on August 3, following the standard protocol procedure (Hinchee et al, 1992), with air injection being performed for 20 hours. Soil gas was sampled for oxygen concentration, carbon dioxide, and hydrocarbon concentration. Oxygen depletion was extremely rapid, with all monitoring points in the contaminated zone reducing from over 18% to less than 5% in less than 3.5 hours. The helium tracer concentration held constant during the test, indicating that leakage and diffusion were insignificant. Carbon dioxide production was insignificant. The background probe indicated very little oxygen depletion during the test.

Due to concern that high chemical oxygen demand (COD) at this site might be contributing to oxygen depletion, it was decided to run a second test at the same monitoring points. The second test was initiated on August 6, 1993. Air and inert tracer (helium 1 to 2%) was injected for an additional 44 hrs. Soil gas monitoring was conducted as in the first experiment. Oxygen depletion was slower than the first, with all monitoring points in the contaminated zone reducing from over 19% to less than 5% in less than 12 hours. The helium tracer concentration held constant during the test, indicating that leakage and diffusion were insignificant. Carbon dioxide production was insignificant. The background probe indicated very little oxygen depletion during the test. See Figure 23 for in situ respiration data for one monitoring point during each test.

The biodegradation rates observed ranged from 68 to 105 mg/kg/day as hexane (based on oxygen utilization rate) for the first test, and 22 to 37 mg/kg/day for the second test. Carbon dioxide production was insignificant at all points. Table 10 presents data for both Kaneohe respiration tests. Soil chemical data is presented in Table 11 and 12. The most noteworthy results are for iron concentration. Iron concentrations ranged from 74,000 mg/kg to 190,000 mg/kg in the three soil samples analyzed. Some portion of the total iron likely would be in the reduced state and would account for a higher than anticipated COD. While it cannot be certain that the COD of the soil had been overcome completely in the second respiration test, it is safe to assume that some portion of the extremely high oxygen utilization rates can be attributed to in situ biodegradation of petroleum contaminants.

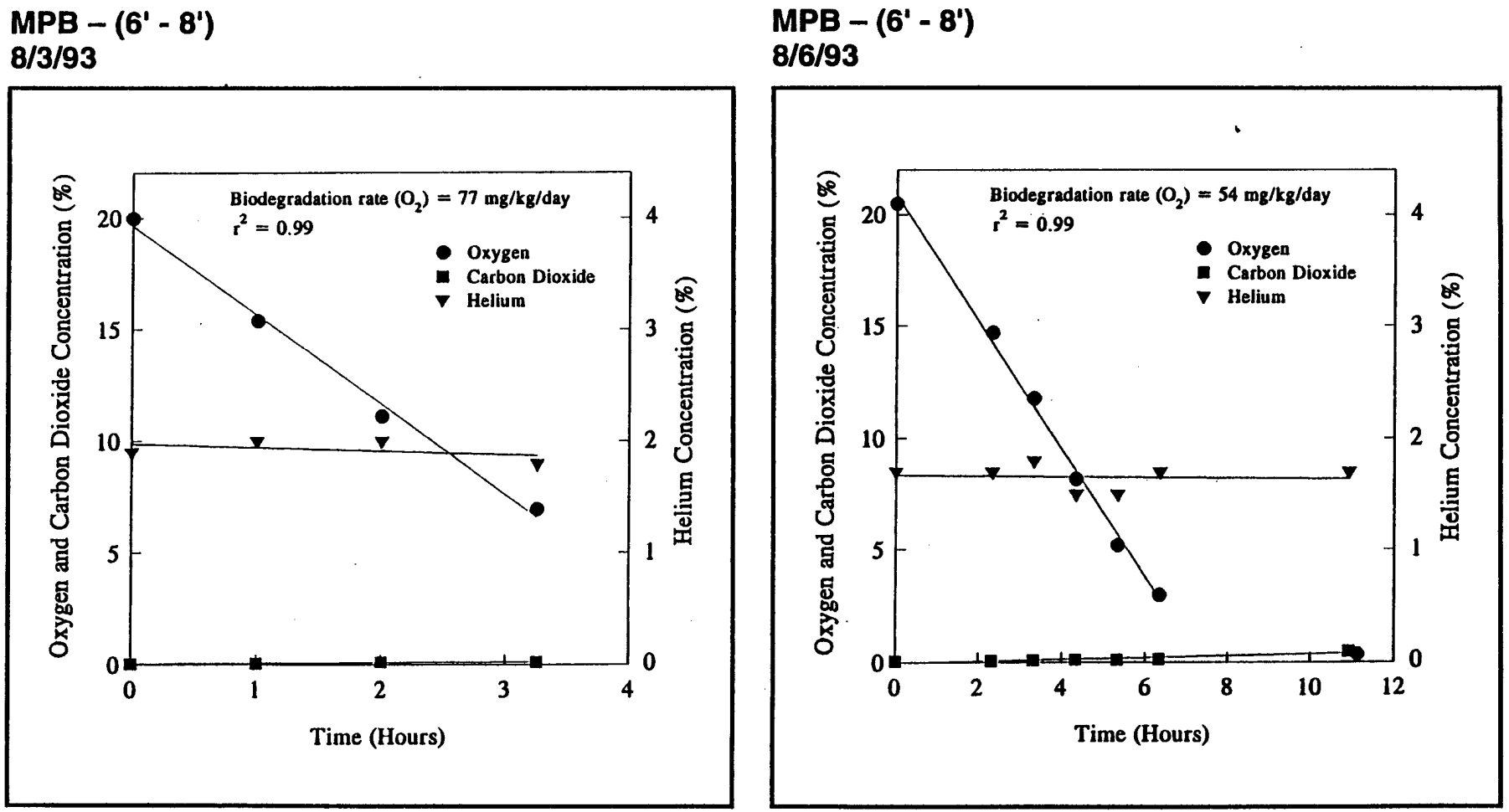

Figure 23. Kaneohe Bay Marine Corps Air Station - In Situ Respiration Data.

Table 10. Kaneohe Bay Marine Air Corps Station - In Situ Respiration Data

Kaneohe O_2 Utilization				
Monitoring Point	Oxygen Utilization Rate (%/hour)		Biodegradation Rate (mg/kg/day)	
Test Date	8/3/93	8/6/93	8/3/93	8/6/93
Background	.06	.06	1.2	1.2
MPA (7.5′ - 8.5′)	3.1	1.1	60	22
MPA (5′ - 6′)	4.1	NS	78	NS
MPB (12.5′ - 16′)	6.4	5.5	122	105
MPB (6′ - 8′)	4	2.8	77	54

The results from the in situ respiration testing at MCAS Kaneohe indicate that bioventing/bioslurping would be very effective for enhancing natural in situ biodegradation at the site. The notion that the lack of biodegradation at the Fallon bioslurper site is due to the JP-5 contaminant constituents can be discounted.

6.4 Future Work

The bioslurper system has been very effective in extracting free product from the Fallon test site. However, the rate of recovery has remained constant, indicating that a great deal of free product remains to be recovered. Future activities will be aimed at optimizing the fuel- recovery process. The new 10-hp, high-vacuum liquid ring pump being installed should help increase system vacuum and fuel-recovery rates. The pump manifold is aging, and some piping likely will need to be replaced to ensure system integrity.

The bioremediation aspect of the Fallon project will focus on identifying the site/contaminant factor that is limiting biodegradation. Future activities will include soil, groundwater, and free-product sampling to investigate possible limiting factors.

The Navy is considering additional work at MCAS Kaneohe Bay, Hawaii. An extended (at least 5 days) air-injection in situ respiration test would be helpful in confirming the effect of the soil COD on oxygen utilization rates. The Navy also is considering a full-scale bioslurper demonstration study at the Kaneohe site.

Table 11. Results From Soil Analyses for BTEX and TPH at Kaneohe

Sample Name	Benzene (*mg/kg)	Toluene (mg/kg)	Ethyl-benzene (mg/kg)	Xylenes (mg/kg)	TPH/ Diesel (mg/kg)
K-3-4′ (080293-03)	< 0.005	< 0.005	0.42	0.58	2000
K2-15-16′ (080293-04)	3.6	0.46	12	23	9200
K4-8-9′ (080293-05)	ND**	ND**	ND**	< 0.010	ND**

** ND: not detected

Table 12. Results From Soil Chemistry Analyses at Kaneohe

Parameter	Sample Name		
	K-3-4′ (080293-03)	K2-15-16′ (080293-04)	K4-8-9′ (080293-05)
Alkalinity, $CaCO_3$ (mg/kg)	500	1400	800
Nitrogen : Nitrate + Nitrite (mg/kg)	4.7	1.5	1.8
Total Kjeldahl Nitrogen (mg/kg)	727	104	102
Total Phosphorus (mg/kg)	2300	430	1000
pH	7.1	7.7	8.5
Iron (mg/kg)	190,000	77,000	74,000
Particle Size (%)	Gravel: 0.1	Gravel: 13.7	Gravel: .2
	Sand: 11.7	Sand: 61.0	Sand: 87.4
	Silt & Clay: 88.2	Silt & Clay: 25.3	Silt & Clay: 12.4

7.0 REFERENCES

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APPENDIX A

ENVIRONMENTAL DISCHARGE PERMITS

BOB MILLER
Governor

STATE OF NEVADA

PETER G. MORROS
Director

R. MICHAEL TURNIPSEED, P.E.
State Engineer

VM FILE & CCBY TO RON HOEPPEL @ NCEL

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

DIVISION OF WATER RESOURCES

Capitol Complex
123 W. Nye Lane
Carson City, Nevada 89710
(702) 687-4380

Re: 57351-E September 1, 1992

Naval Air Station, Fallon
Public Works Department
Environmental Division
Fallon, NV 89406-5000

Gentlemen:

Enclosed herewith you will find Permit No. 57351-E which is being issued for environmental purposes pursuant to Chapter 289 of the 1991 Legislature.

You are advised that this Environmental Permit expires upon termination of clean-up activity as determined by the Nevada Division of Environmental Protection. If you have any questions, please contact this office.

Very truly yours,

R. Michael Turnipseed P.E.

R. Michael Turnipseed, P.E.
State Engineer

RMT/ap

Enclosures

cc: Division of Environmental Protection

ENVIRONMENTAL

No. 57351

APPLICATION FOR PERMIT
TO APPROPRIATE THE PUBLIC WATERS OF THE STATE OF NEVADA

Date of filing in State Engineer's Office MAR 2 6 1992

Returned to applicant for correction

Corrected application filed

Map filed MAR 2 6 1992

The applicant Naval Air Station, Fallon - Public Works Dept.

Environmental Division (Street and No. or P.O. Box No.), of Fallon, (City or Town),

Nevada 89406 - 5000 (State and Zip Code No.), hereby make application for permission to appropriate the public waters of the State of Nevada, as hereinafter stated. (If applicant is a corporation, give date and place of incorporation; if a copartnership or association, give names of members.) The operation of a research soil remediation system which will pump groundwater at maximum of 25 gpm to remove spilled fuel from the subsurface.

1. The source of the proposed appropriation is ground water (Name of stream, lake, spring, underground or other source)

2. The amount of water applied for is 0.056 (25gpm) second-feet (One second-foot equals 448.83 gals. per min.)

   (a) If stored in reservoir give number of acre-feet

3. The water to be used for environmental research project - water will be discharged to sanitary sewer. (Irrigation, power, mining, manufacturing, domestic, or other use.)

4. If use is for:

   (a) Irrigation, state number of acres to be irrigated N/A

   (b) Stockwater, state number and kinds of animals to be watered N/A

   (c) Other use (describe fully under No. 12. "Remarks" Recovery of spilled fuel.

   (d) Power:

      (1) Horsepower developed N/A

      (2) Point of return of water to stream N/A

5. The water is to be diverted from its source at the following point said point is located in the (Describe as being within a 40-acre subdivision of public survey, and by course and distance to a section corner. If on unsurveyed land, it should be so stated.) NW¼ of NW¼, Sec. 15, T18N, R29E, MDB&M; from whence the W¼ corner of Section 10, T18N, R29E, MDB&M bears N 13°57'41"W a distance of 3312.59 feet. (HA 101), UTM N4365.95 Km, E352.17 Km (zone 11)

6. Place of use Section 15, T18N, R29E, MDB&M; (HA 101) UTM N4365.95 Km, E352.17 Km (zone 11) (Describe by legal subdivision. If on unsurveyed land, it should be so stated.)

7. Use will begin about April 1 (Month and Day) and end about March 31 (Month and Day), of each year. (1992-1995)

8. Description of proposed works. (Under the provisions of NRS 535.010 you may be required to submit plans and specifications of your diversion or storage works.) 10 Hp above ground pump will be plumbed to 48 2" i.d. pvc wells (See attachment A). (State manner in which water is to be diverted, i.e. diversion structure, ditches and flumes, drilled well with pump and motor, etc.)

9. Estimated cost of works.....

10. Estimated time required to construct works..... See attachment A for description of works.
If well completed, describe works.

11. Estimated time required to complete the application of water to beneficial use..... System will be fully operational at time of full-scale start-up.

12. Remarks: For use other than irrigation or stock watering, state number and type of units to be served or annual consumptive use:

This project is an in situ bioremediation research project. Water is being removed in conjuction with the recovery of spilled JP-5 jet fuel. Maximum water flow will be at 25 gpm with continuous operation. Water will be primarily discharged to sanitary sewer, but may also be used to irrigate the treatment site (approx. 1 acre).

By s/ illegible
NAVAL AIR STATION, FALLON PUBLIC WORKS
FALLON, NV 89496-5000 DEPT.

Compared ap/ se ap/se

Protested.....

APPROVAL OF STATE ENGINEER

This is to certify that I have examined the foregoing application, and do hereby grant the same, subject to the following limitations and conditions:

This permit is issued subject to existing rights on the source. It is understood that the amount of water herein granted is only a temporary allowance for the determination if contaminated soil or groundwater exists at this site and if a remediation plan will need to be implemented. This permit will allow the withdrawal of groundwater for any remediation plan. A totalizing meter must be installed and maintained in the discharge pipeline near the point of diversion and accurate measurements kept of the amount of water pumped. It is understood that this right must allow for a reasonable lowering of the static water level of permittee's well due to other groundwater development in the area. The well shall be equipped with a 2-inch opening for measuring depth to water. The state retains the right to regulate the use of water granted herein at any and all times.

The right granted under this permit will cease upon the termination of this project.

This permit does not extend the permittee the right of ingress and egress on public, private or corporate lands.

(CONTINUED ON PAGE 2)

The amount of water to be appropriated shall be limited to the amount which can be applied to beneficial use, and not to exceed 0.056 cubic feet per second, but not to exceed 13.21 million gallons annually.

Work must be prosecuted with reasonable diligence and be completed on or before.....

Proof of completion of work shall be filed before.....

Application of water to beneficial use shall be filed on or before.....

Proof of the application of water to beneficial use shall be filed on or before.....

Map in support of proof of beneficial use shall be filed on or before.....

ENVIRONMENTAL

Completion of work filed.....

Proof of beneficial use filed.....

Cultural map filed.....

Certificate No..... Issued.....

ENVIRONMENTAL

IN TESTIMONY WHEREOF, I, R. MICHAEL TURNIPSEED, P.E. State Engineer of Nevada, have hereunto set my hand and the seal of my office, this 1st day of September A.D. 1992

State Engineer

(PERMIT TERMS CONTINUED)

The issuance of this permit does not waive the requirements that the permit holder obtain other permits from State, Federal and local agencies.

This permit is issued pursuant to the provisions of NRS 533.4375. Well drillers reports for any well(s) drilled under this permit shall be filed within 30 days from the completion of the well.

Within 30 days after the completion of the project, the permittee shall notify the State Engineer of such completion and all wells shall be plugged and abandoned in accordance with Chapter 534 of the Nevada Administrative Code.

Monthly records shall be kept of the amount of water pumped from this well and the records submitted to the State Engineer on a quarterly basis within 15 days after the end of each calendar quarter.

STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION
BUREAU OF AIR QUALITY
123 WEST NYE LANE
CARSON CITY, NEVADA 89710

NO. 2892

AIR QUALITY PERMIT TO CONSTRUCT

Issued to: DEPARTMENT OF THE NAVY
NAVAL AIR STATION, FALLON, NEVADA 89406-5000
Location: SECTION 15, T18N, R29E, MDB&M (HA 101)
UTM N4365.95 KM, E352.17 KM (ZONE 11)

is granted a permit to construct, modify or establish the following source of air contaminant:

In Situ Soil Venting Bioremediation Pilot Study on 0.5 acre of JP-5 contaminated soil, consisting of: system of 2-inch diameter PVC dewatering wells spaced approximately 20 feet apart, dewatering pump to remove liquid and vapor from the surface which contains a separation compartment to separate liquid from the vapor; stack through which the vapor will be discharged; oil/water separator; and a 500 gallon tank to store free-phase oil;

in accordance with Nevada Administrative Code (NAC) 445.430 through 445.846 and the plans, specifications or other materials submitted.

Restrictions:

1. Facilities Operation

   All equipment, facilities, and systems installed or used to achieve compliance with the terms and conditions of the Permit to Construct shall at all times be maintained in good working order and be operated as efficiently as possible so as to minimize air pollutant emissions.

2. Excess Emissions

   The Bureau of Air Quality shall be notified by telephone within 24 hours following any failure of air pollution control equipment, process equipment, or of a process, to operate in a normal manner which results in an increase in emissions above any allowable emissions limit stated in the permit to construct restrictions. In addition, the Bureau of Air Quality shall be notified in writing within fifteen (15) days of any such failure. This notification shall include a description of the malfunctioning equipment or abnormal operation, the date of the initial failure, the period of time over which emissions were increased due to the failure, the cause of the failure, the estimated resultant emissions in excess of those allowed under the Permit to Construct, and the methods utilized to restore normal operations. Compliance with this malfunction notification provision shall not excuse or otherwise constitute a defense to any violations of this permit or of any law or regulations which such malfunction may cause.

3. Right to Entry

   The Bureau of Air Quality staff, upon the presentation of credentials, shall be permitted at any time:

   A. to enter upon the premises where the source is located or in which any records are required to be kept under the terms and conditions of the Permit to Construct;

   B. to have access to and copy any records required to be kept under the terms and conditions of the Permit to Construct;

   C. to inspect any equipment, operation, or method required in the Permit to Construct;

   D. to sample emissions from the source or other process materials and conditions.

4. Severability

   The provisions of the Permit to Construct are severable, and if any provision of the Permit to Construct is held invalid, the remainder of the Permit to Construct shall not be affected thereby.

5. Other Applicable Regulations

   The owner or operator of the facility shall operate in compliance with all other applicable provisions of 40 CFR Parts 60 and 61 and Nevada Administrative Code 445.430 through 445.846.

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Restrictions Continued:

6. Special Conditions

   A. Performance Tests

      1. An EPA Method 25A performance test consisting of three valid runs for total petroleum hydrocarbons must be conducted in accordance with the procedures and methods specified in Nevada Administrative Code 445.682 and, where applicable, 40 CFR 60.8, within 60 days after initial startup. All performance tests shall be conducted at the maximum volume of the source, ±20% if approved by the Bureau of Air Quality.

      2. The Bureau of Air Quality shall be notified in writing and the performance test protocols submitted for review at least 30 days prior to such tests to allow time to arrange for an observer to be present at the tests. Prior approval of the stack emission test protocols will minimize the possibility of the Bureau of Air Quality's rejection of test results for procedural deficiencies.

      3. A copy of the performance test results must be submitted to the Bureau of Air Quality by the testing firm or the company within 60 days after such test is completed, in accordance with Nevada Administrative Code 445.682.

   B. Emission Limits

      On and after the date of startup of the Pilot Study, the Department of the Navy shall not discharge or cause the discharge of total petroleum hydrocarbons into the atmosphere from the vapor discharge pipe, in amounts which would cause a violation of any applicable ambient air quality standard.

7. Noncompliance with any restrictions of the Permit to Construct (defined in Nevada Administrative Code 445.5635) shall be deemed a violation of Nevada Administrative Code 445.430 through 445.846 and a Notice of Alleged Violation may be issued.

8. Fugitive dust from the handling, transporting or storing of any material must be controlled in accordance with NAC 445.734.

9. The Bureau of Air Quality must be notified in writing of commencement of construction, completion of construction, and commencement of operation in accordance with NAC 445.681.

10. The owner/operator subject to the restrictions of this Permit to Construct shall cease operation when an upset or malfunction to the process or control equipment causes excess emissions, as defined in NAC 445.504.

11. Local grading, building, health or any other permits must be obtained from the appropriate agency as the issuance of this permit to construct does not preclude the necessity for their procurement.

12. This permit to construct expires if construction of the source is not commenced within one year from the date of issuance or construction of the source is delayed for one year after initiated.

13. The act of any person who:

   A. makes any false material statement, representation, or certification in, or omits material information from, or alters, conceals, or fails to file or maintain any notice, application, record, report, plan, or other document required by the permit or director;

   B. fails to notify or report as required by the permit or director;

   C. falsifies, tampers with, renders inaccurate, or fails to install any monitoring device or method required by the permit or director;

   shall constitute a violation of this permit and may result in a revocation of this permit.

STATE OF NEVADA
DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION
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NO. 2892

AIR QUALITY PERMIT TO CONSTRUCT

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Location: SECTION 15, T18N, R29E, MDB&M (HA 101)
UTM N4365.95 KM, E352.17 KM (ZONE 11)

Restrictions Continued:

14. The proposed facility is subject to and must comply with the Clean Air Act, including the provisions of the 1990 amendments and any regulations adopted by the Federal Government and/or the State of Nevada pursuant thereto.

15. The blue copy of this permit must be signed and returned to the Bureau of Air Quality postmarked within ten days of receipt. Failure to do so will result in this permit being invalidated.

This permit:

1. **Is non-transferable in accordance with NAC 445.704.**
2. **Is issued on condition that the holder allows inspection of the premises by authorized representatives of the department at any time during hours of construction or operation, without prior notice.**
3. **Is issued on condition of acceptance of all restrictions and conditions contained on this permit as evidenced by the signing hereof by an authorized representative.**

Signature _____ **Signature** _____
Issued by Lowell H. Shifley, Jr., P.E. **Print Name** MAEK LEEMASTER
Chief, Bureau of Air Quality
Authorized Representative of
Department of the Navy

Phone 687-5065 **Date** Nov. 1, 1991 **Phone** _____ **Date** _____

PETER G. MORROS
Director

STATE OF NEVADA
BOB MILLER
Governor

L. H. DODGION
Administrator

Administration	(702) 687-4670
Air Quality	687-5065
Mining Regulation and Reclamation	687-4670
Waste Management	687-5872
Federal Facilities	687-3880

Chemical Hazards Management	687-5872
Water Pollution Control	687-4670
Water Quality Planning	687-4670
FAX	885-0868

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

DIVISION OF ENVIRONMENTAL PROTECTION

333 W. Nye Lane

Carson City, Nevada 89710

August 27, 1992

C.C. Baker, LCDR, CEC, USN
Public Works Officer
U.S. Department of the Navy
Fallon, NV 89406-5000

Dear Mr. Baker:

In accordance with provisions of the Federal Water Pollution Control Act (33 U.S.C. 1251, et. seq.) and the Nevada Water Pollution Control Law Chapter 445, of the Nevada Revised Statutes, the Department of Conservation and Natural Resources, Division of Environmental Protection has reviewed the following application for a permit to discharge:

Discharger	Permit Number
U.S. Dept. of the Navy	NEV91046

This office published a public notice of our proposed action in the July 17, 1992 edition of the Reno Gazette-Journal. The notice was also sent to interested persons on our mailing list.

After consideration of all comments received during the 30 day comment period, the Division of Environmental Protection is issuing the enclosed permit to U.S. Department of the Navy. This action does not constitute a significant change from the tentative determinations set forth in the public notice.

Enclosed for your use are the following Discharge Monitoring Report (DMR) forms which must be used for submitting data to this office at the address listed in the permit. Copies of this form can be made and used to report on a quarterly basis as required. The next Discharge Monitoring Report is due on October 28, 1992 and quarterly thereafter.

In accordance with permit condition Item 10 page 3 and NAC 445.144 a review and services annual fee is due on July 15, 1993 and will be past due on August 15, 1993. The amount of the annual fee at this time is $1500.

The permit shall take effect on August 29, 1992. If you have any questions on this matter please feel free to contact me at (702) 687-5870.

Sincerely,

John Nelson

John Nelson, P.E., P.L.S.
Permits Branch Supervisor
Bureau of Water Pollution Control

JN/to:76
USNavy.dp
Enclosures

cc: Dick Reavis
Dave Chesmore
Jeff Kettle (Battelle Inc.)✓

Permit No. NEV91046

AUTHORIZATION TO DISCHARGE

In compliance with the provisions of the Federal Water Pollution Control Act as amended, (33 U.S.C. 1251 et. seq; the "Act"), and Chapter 445 of the Nevada Revised Statutes,

United States Department of the Navy
Fallon Naval Air Station
Fallon, Nevada 89406-5000

is authorized to discharge from a facility located at

Fallon Naval Air Station
New Fuel Farm Facility

to receiving waters named

Fallon Naval Air Station
Sanitary Sewer System

in accordance with effluent limitations, monitoring requirements, and other conditions set forth in Part I, II and III hereof.

This permit shall become effective on August 29 1992.

This permit and the authorization to discharge shall expire at midnight, August 29 1997.

Signed this 29th day of August, 1992.

John Nelson, Environmental Engineer
Bureau of Water Pollution Control

JN/to:WP2
FNASFuelF.pmt

Part I

A. EFFLUENT LIMITATIONS, MONITORING REQUIREMENTS AND CONDITIONS

1. During the period beginning on the effective date of this permit, and lasting until the permit expires, the permittee is authorized to discharge from 1 outfall at the oil water separator to the sanitary sewer system only.

Samples taken in compliance with the monitoring requirements specified below shall be taken at the following location(s): At the point of discharge from the oil water separator outfall pipe to the sanitary sewer connection.

The discharge shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS		MONITORING REQUIREMENTS	
	30-day average	Daily Max.	Measurement Frequency	Sample Type
Flow	.036	--	Continuous	Continuous
*Total Petroleum Hydrocarbons	--	20 ppm	Monthly	Discrete
pH	Shall not be less than 6.0 S.U. nor Greater than 9.0 S.U.		Monthly	Discrete

---

* Sampled daily for first two days, weekly for three weeks and monthly thereafter.

Part I.A. (continued)

2. The treatment works shall not cause objectionable odors in the collection system or treatment facility or disposal site.

3. There shall be no discharge of substances that would cause a violation of water quality standards of the State of Nevada.

4. All solid waste shall be disposed pursuant to approval of the Division.

5. There shall be no discharge from the collection, treatment and disposal facilities except as authorized by this permit.

6. The treatment and disposal facility shall be fenced and posted.

7. The collection, treatment and disposal facilities shall be constructed in conformance with plans approved by the Division. Any change to the approved plans must be sent immediately to the Division for approval.

8. The facility shall be operated in accordance with the Operations and Maintenance Manual which must be approved by the Division.

9. There shall be no discharge of floating solids or visible foam in other than trace amounts.

10. The permittee shall remit an annual review and services fee in accordance with NAC 445.144 starting July 1, 1992 and every year thereafter until the permit is terminated.

B. SCHEDULE OF COMPLIANCE

1. The permittee shall achieve compliance with the effluent limitations upon issuance of the permit.

2. No later than 14 calendar days following the date of issuance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

3. The Administrator, may upon request of the permittee and after public notice, revise or modify a schedule of compliance in an issued permit if he determines good and valid cause (strike, flood, materials shortage or other event over which the permittee has little or no control) exists for such revision.

C. MONITORING AND REPORTING

1. Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. Analysis shall be performed by a laboratory certified by the State of Nevada.

2. Reporting

Monitoring results obtained during the previous three (3) months shall be summarized for each month and reported on a Discharge Monitoring Report Form postmarked no later than the 28th day of the month following the completed reporting period. The first report is due on October 28, 1993. A signed copy of these, and all other reports required herein, shall be submitted to the State at the following address:

Division of Environmental Protection
Bureau of Water Pollution Control
ATTN: Shannon R. Bell
333 West Nye Lane
Capitol Complex
Carson City, Nevada 89710

3. Definitions

a. The "30-day average discharge" means the total discharge during a month divided by the number of days in the period that the facility was discharging. Where less than daily sampling is required by this permit, the 30-day average discharge shall be determined by the summation of all the measured discharges divided by the number of days during the period when the measurements were made.

If fewer than four measurements are made during a month, then compliance or noncompliance with the 30-day average discharge limitations shall not be determined.

b. The "daily maximum" discharge means the total discharge during any calendar day.

c. The "30-day average concentration", other than for fecal coliform bacteria, means the arithmetic mean of measurements made during a month. The "30-day average concentration" for fecal coliform bacteria means the geometric mean of measurements made during a month. The geometric mean is the "n^{th}" root of the product of "n" numbers.

Part I.C. (cont.)

If fewer than four measurements are made during a month, the compliance or noncompliance with the 30-day average concentration limitation shall not be determined.

d. The "daily maximum" concentration means the measurement made on any single discrete sample or composite sample.

e. A "discrete" sample means any individual sample collected in less than 15 minutes.

f. A "composite" sample means, for flow rate measurements, the arithmetic mean of no fewer than four individual measurements taken at equal time intervals for eight hours, or for the duration of discharge, whichever is shorter. A "composite" sample means, for other than flow rate measurements, a combination of no fewer than four individual samples obtained at equal time intervals for either eight hours, or for the duration of discharge, whichever is shorter. The volume of each individual sample shall be proportional to the discharge flow rate at the time of sampling.

4. Test Procedures

Test procedures for the analysis of pollutants shall conform to regulations (40 CFR, Part 136) published pursuant to Section 304(h) of the Act, under which such procedures may be required unless other procedures are approved by the Division.

5. Recording the Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. the exact place, date, and time of sampling;
b. the dates the analyses were performed;
c. the person(s) who performed the analyses;
d. the analytical techniques or methods used; and
e. the results of all required analyses.

6. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report Form. Such increased frequency shall also be indicated.

Part I.C. (cont.)

7. Records Retention

All records and information resulting from the monitorin activities required by this permit, including all records o analyses performed and calibration and maintenance o instrumentation and recordings from continuous monitorin instrumentation, shall be retained for a minimum of three (3 years, or longer if required by the Administrator.

8. Modification of Monitoring Frequency and Sample Type

After considering monitoring data, stream flow, discharge flow an receiving water conditions, the Division, may for just cause. modify the monitoring frequency and/or sample type by issuing a order to the permittee.

9. Permit Modification and Reissuance

This permit may be modified, or alternatively, revoked an reissued, to comply with any applicable effluent limitation issue pursuant to the order of the United States District Court for the District of Columbia issued on June 8, 1976, in Natural Resources Defense Council, Inc. et al. vs. Russell E. Train, 8 ERC 212 (D.D.C. 1976), if the effluent limitations so issued:

a. is different in conditions or more stringent than any effluent limitations in the permit; or

b. controls any pollutant not limited in the permit.

PART II

A. MANAGEMENT REQUIREMENTS

1. Change in Discharge

All discharges authorized herein shall be consistent with the term and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level i excess of that authorized shall constitute a violation of the permit. Any anticipated facility expansions, or treatmen modifications which will result in new, different, or increase discharges of pollutants must be reported by submission of a ne application or, if such changes will not violate the effluen limitations specified in this permit, by notice to the permi issuing authority of such changes. Any changes to the permitte treatment facility must comply with Nevada Administrative Cod (NAC) 445.179 to 445.181. Pursuant to NAC 445.174, the permit ma be modified to specify and limit any pollutants not previousl limited.

Part II.A. (continued)

2. Facilities Operation

The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities, collection systems or pump stations installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

3. Adverse Impact

The permittee shall take all reasonable steps to minimize any adverse impact to receiving waters resulting from noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

4. Noncompliance, Unauthorized Discharge, Bypassing and Upset

a. Any diversion, bypass, spill, overflow or discharge of treated or untreated wastewater from wastewater treatment or conveyance facilities under the control of the permittee is prohibited except as authorized by this permit. In the event the permittee has knowledge that a diversion, bypass, spill, overflow or discharge not authorized by this permit is probable, the permittee shall notify the of Division immediately.

b. The permittee shall notify the Division within twenty-four (24) hours of any diversion, bypass, spill, upset, overflow or discharge of treated or untreated sewage other than that which is authorized by the permit. A written report shall be submitted to the Administrator within five (5) days of diversion, bypass, spill, overflow, upset or discharge detailing the entire incident including:

(1) time and date of discharge;
(2) exact location and estimated amount of discharge;
(3) flow path and any bodies of water which the discharge reached;
(4) the specific cause of the discharge; and
(5) the preventive and/or corrective actions taken.

c. The following shall be included as information which must be reported within 24 hours: any unanticipated bypass which exceeds any effluent limitation in the permit; any upset which exceeds any effluent limitation in the permit; and violation of a limitation for any toxic pollutant or any pollutant identified as the method to control a toxic pollutant.

Part II.A. (cont.)

d. The permittee shall report all instances of noncompliance not reported under Part II.A.4.b. at the time monitoring reports are submitted. The reports shall contain the information listed in Part II.A.b.

e. An "upset" means an incident in which there is unintentional and temporary noncompliance with the permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.

f. In selecting the appropriate enforcement option, the Division shall consider whether or not the noncompliance was the result of an upset.

g. The burden of proof is on the permittee to establish that an upset occurred.

In order to establish that an upset occurred, the permittee must provide, in addition to the information required under paragraph II.A.4.b. above, properly signed contemporaneous logs or other documentary evidence that:

(1) The facility was at the time being properly operated as required in paragraph II.A.2. above; and

(2) All reasonable steps were taken to minimize adverse impacts as required by paragraph II.A.3. above.

5. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of waste waters shall be disposed of in a manner such as to prevent any pollution from such materials from entering any navigable waters.

6. Safeguards to Electric Power Failure

In order to maintain compliance with the effluent limitations and prohibitions of this permit the permittee shall either:

a. provide at the time of discharge an alternative power source sufficient to operate the wastewater control facilities;

b. halt or reduce all discharges upon the reduction, loss, or failure of the primary source of power to the wastewater control facilities.

B. RESPONSIBILITIES

1. Right of Entry

The permittee shall allow the Administrator and/or his authorized representatives, upon the presentation of credentials:

a. to enter upon the permittee's premises where an effluent source is located or in which any records are required to be kept under the terms and conditions of this permit; and

b. at reasonable times, to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect any monitoring equipment or monitoring method required in this permit; and to perform any necessary sampling to determine compliance with this permit or to sample any discharge.

2. Transfer of Ownership or Control

In the event of any change in control or ownership of facilities from which the authorized discharge emanates, the permittee shall notify the succeeding owner or controller of the existence of this permit, by letter, a copy of which shall be forwarded to the Administrator. ALL transfer of permits shall be approved by the Division.

3. Availability of Reports

Except for data determined to be confidential under NRS 445.311, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the office of the Division. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in NRS 445.337.

4. Furnishing False Information and Tampering with Monitoring Devices

Any person who knowingly makes any false statement, representation, or certification in any application, record, report, plan or other document filed or required to be maintained by the provisions of NRS 445.131 to 445.354, inclusive, or by any permit, rule, regulation or order issued pursuant thereto, or who falsifies, tampers with or knowingly renders inaccurate any monitoring device or method required to be maintained under the provisions of NRS 445.131 to 445.354, inclusive, or by any permit, rule, regulation or order issued pursuant thereto, is guilty of a gross misdemeanor and shall be punished by a fine of not more than $10,000 or by imprisonment. This penalty is in addition to any other penalties, civil or criminal, provided pursuant to NRS 445.131 to 445.354, inclusive.

Part II.B. (cont.)

5. Penalty for Violation of Permit Conditions

Nevada Revised Statutes (NRS) 445.317 provides that any person who violates a permit condition is subject to administrative and judicial sanctions as outlined in NRS 445.324 through 445.334.

6. Permit Modification, Suspension or Revocation

After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:

a. violation of any terms or conditions of this permit;

b. obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. a change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

7. Toxic Pollutants

Notwithstanding Part II.B.6. above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be revised or modified in accordance with the toxic effluent standard or prohibition and the permittee so notified.

8. Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable Federal, State or local laws, regulations, or ordinances.

9. Property Rights

The issuance of this permit does not convey any property rights, in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

Part II.B. (cont.)

10. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provisions of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

PART III

A. OTHER REQUIREMENTS

1. Reapplication

If the permittee desires to continue to discharge, he shall reapply not later than 180 days before this permit expires on the application forms then in use.

2. Signatory Requirements

a. Applications. All permit applications shall be signed as follows:

(1) For a corporation: by a responsible corporate officer. For the purposes of this section, a responsible corporate officer means (a) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or (b) the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

(2) For a partnership or sole proprietorship: by a general partner or proprietor, respectively; or

(3) For a municipality, State, Federal, or other public agency: by either a principal executive officer or ranking elected official. For purposes of this section, a principal executive officer of a Federal Agency includes (a) the chief executive officer of the agency, or (b) a senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.

Part III.A. (cont.)

b. Reports. All reports required by permits and other information requested by the Administrator shall be signed by a person described in paragraph a. of this section, or by a duly authorized representative of that person. A person is a duly authorized representative only if:

(1) The authorization is made in writing by a person described in paragraph a. of this section;

(2) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, operator of a well or a well field, superintendent, or position of equivalent responsibility. (A duly authorized representative may thus be either a named individual or any individual occupying a named position.); and

(3) The written authorization is submitted to the Division.

c. Changes to authorization. If an authorization under paragraph b. of this section is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization satisfying the requirements of paragraph b. of this section must be submitted to the Division prior to or together with any reports, information, or applications to be signed by an authorized representative.

d. Certification. Any person signing a document under paragraphs a. or b. of this section shall make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am

aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Part III.A (cont.)

3. Holding Pond Conditions

If any wastewater from the permittee's facility is placed in ponds, such ponds shall be located and constructed so as to:

a. contain with no discharge the once-in-one-hundred year storm at said location;

b. withstand with no discharge the once-in-one-hundred year flood of said location; and

c. prevent escape of wastewater by leakage other than as authorized by this permit.

4. Flow Rate Notification

The permittee shall notify the Administrator, by letter, not later than ninety (90) days after the 30-day average daily influent flow rate first equals or exceeds 85% of the design treatment capacity of the permittee's facility given in Part I.A. above. The letter shall include:

a. The 30-day average daily influent flow rate;

b. The maximum 24-hour flow rate during the 30-day period reported above and the date the maximum flow occurred;

c. The permittee's estimate of when the 30-day average influent flow rate will equal or exceed the design treatment capacity of the permittee's facility; and

d. A status report on the treatment works which will outline but not be limited to past performance, remaining capacity of the limiting treatment and disposal units or sites, past operational problems and improvements instituted, modifications to the treatment works which are needed to attain the permitted flow rate due to changing site specific conditions or design criteria; and

e. The permittee's schedule of compliance to provide additional treatment capacity before the 30-day average daily influent flow rate equals the present design treatment capacity of the permittee's facility.

The permittee shall implement and comply with the provisions of the schedule of compliance after approval by the Administrator, including in said implementation and compliance, any additions or modifications which the Administrator may make in approving the schedule of compliance.

BOB MILLER
Governor

STATE OF NEVADA

PETER G. MORROS
Director

R. MICHAEL TURNIPSEED, P.E.
State Engineer

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

DIVISION OF WATER RESOURCES
Capitol Complex
123 W. Nye Lane
Carson City, Nevada 89710
(702) 687-4380

October 24, 1991

Jeffrey A. Kittel
Battelle
505 King Avenue
Columbus, OH 43201-2693

Re: Waiver request for site remediation at the Fallon Naval Air Station, Fallon, Nevada;

Dear Mr. Kittel:

Under the provisions of Assembly Bill 722 as approved by Governor Robert Miller, effective October 1, 1991, the State Engineer has the authority to issue a temporary water appropriation permit to avoid pollution or contamination of a water source (copy enclosed).

An application for an "environmental permit" must be submitted with all of the information contained in a standard application to appropriate including the reproducable map prepared by a Nevada licensed water rights surveyor and a $150.00 filing fee. Additionally a copy of a letter or order from the Division of Environmental Protection requiring the applicant to take steps to protect the environment must be attached along with any additional information necessary for a complete understanding of the need for the appropriation.

An application for an "environmental permit" is not required to go through either a publication or protest period, therefore this office intends to process and decide on all "environmental permit" applications within ten working days of receipt of a complete, correct application.

Multiple points of diversion (wells) may be listed on a single application as long as they are all within the same forty acre subdivision.

If the anticipated well design will not conform to the regulations for water well and related drilling as adopted under Chapter 534 of the Nevada Administrative Code (NAC) a separable request for a waiver of the pertinent regulations as provided in NAC 534.450 must be attached.

If you have any questions please feel free to contact this office at the above listed number.

Sincerely,

Michael J. Anderson
Hydraulic Engineer I

MJA/jjs

BOB MILLER
Governor

STATE OF NEVADA

PETER G. MORROS
Director

R. MICHAEL TURNIPSEED, P.E.
State Engineer

DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

DIVISION OF WATER RESOURCES
Capitol Complex
123 W. Nye Lane
Carson City, Nevada 89710
(702) 687-4380

R-139

October 24, 1991

Jeffrey A. Kittel
Battelle
505 King Avenue
Columbus, OH 43201-2693

RE: Forty-Eight (48) 2-inch extraction wells for Fallon Naval Air Station, Churchill County, Nevada; Location HA - 101 N18 E29 15 BB

Dear Mr. Kittel:

As provided in Section 534.450 of the Regulation for Water Well and Related Drilling as adopted under Chapter 534 of the Nevada Administrative Code, and for good cause shown, authorization is herewith granted to complete the subject well as described below.

Two-inch PVC wells in six-inch bore-holes, sand packed with cement surface seal from depth of bentonite plug to surface. NAC Sections 534.360(3) and 534.380(1) are hereby waived per your request dated October 16, 1991.

Full compliance with the remainder of the statute and regulation is required. The well net may be pump tested for no longer 72-hours. Maximum water discharge shall not exceed 18,000 gallons for this test. An "environmental permit" must be applied for and granted prior to any discharge of water beyond that authorized above for a well net test. The subject wells must be properly plugged and abandoned as required under NAC 534.420 upon project completion or one year from the date of this letter, whichever occurs first. Please include as accurate a description as possible of each location of the well on the completion reports. It is expressly understood this authorization does not relieve the operator of the permitting requirements of other state, federal and local agencies.

A copy of this authorization must be transmitted to the on-site well driller prior to starting any drilling.

If any questions arise please contact this office at 702-687-4380.

Sincerely,

Michael J. Anderson
Hydraulic Engineer I

MJA/jjs

cc: NDEP
Gary Robertson, Environmental Director

NAS FALLON
IN SITU SOIL VENTING
BIOREMEDIATION FIELD PILOT STUDY
AIR DISCHARGE
PERFORMANCE TEST REPORT

INTRODUCTION

This report presents the results of the Air Discharge Performance Test performed on the NAS Fallon bioventing system on March 16, 1993. The test was performed to characterize the air flow and discharge TPH concentration of bioventing soil remediation system. The remediation system is designed to address a JP-5 jet fuel release in a area west of the of the NAS Fallon fuel tank farm. The system is designed to remove JP-5 constituents from the subsurface in free phase (liquid), dissolved (aqueous), and gaseous form. This procedure deals only with quantifying the mass of JP-5 constituents discharged to the atmosphere in gaseous form. The bioventing system was installed under Air Quality Permit to Construct No. 2892.

RESULTS

Total Petroleum Hydrocarbon (TPH) Concentration

A total of 6 (3 samples in duplicate) stack vapor discharge samples were collected during the air discharge performance test. Sample concentrations ranged from 900 mg/m^3 to 1500 mg/m^3, with an average concentration of 1300 mg/m^3.

Air Flow Measurement

A total of 6 flow measurements were taken from the in-line rotometer on the bioventing system discharge stack. Flows ranged from 50 cfm to 52 cfm, with an average flow of 51 cfm or

1.43 m^3/min.

Daily Discharge Results

Table 1 summarizes the results of the NAS Fallon Air discharge Performance Test. At an average flow rate of 1.43 m^3/day and an average discharge TPH (as JP-5 jet fuel) concentration of 1300 mg/m^3, the mass of hydrocarbons discharged per day from the NAS Fallon bioventing system is 2,672 grams per day, or 5.89 lbs/day.

TABLE 1. NAS FALLON AIR DISCHARGE PERFORMANCE TEST RESULTS

Sample I.D.	Concentration mg/m^3	Duplicate Average	System Flow cfm
NASF-S1A	900		50
NASF-S1B	1100	1000	50
NASF-S2A	1500		52
NASF-S2B	1400	1450	52
NASF-S3A	1400		50
NASF-S3B	1500	1450	50

Stack Vapor Average Concentration = 1300 mg/m^3
Stack Discharge Average Flow = 51 cfm = 1.43 m^3/day
Stack Daily Discharge = 2056 m^3/day
TPH Discharge = 5.89 lbs/day.

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, Nevada 89431
702 355-1044
FAX: 702-355-0406
1-800-283-1183

Boise, Idaho
(208) 336-4145

2810 W. Charleston, Suite G67
Las Vegas, Nevada 89102
(702) 386-6747

ANALYTICAL REPORT

Battelle
505 King Ave
Columbus Ohio 43201

Job#: 42880
Phone: (614) 424-6122
Attn: Jeff Kittel

Sampled: 03/16/93 Received: 03/17/93 Analyzed: 03/28/93

Matrix: [ ] Soil [ ] Water [X] Air Cartridge

Analysis Requested: TPH - Total Petroleum Hydrocarbons in Air
BTXE - Benzene,Toluene,Xylenes,Ethylbenzene in Air

Results:

Client ID/ Lab ID	Parameter	Concentration mg/m3 in Air	Detection Limit mg/m3 in Air
NASF-S1A /BMI031793-01	TPH (JP5)	900	100 mg/m3
NASF-S1B /BMI031793-02	TPH (JP5)	1,100	100 mg/m3
NASF-S2A /BMI031793-03	TPH (JP5)	1,500	100 mg/m3
NASF-S2B /BMI031793-04	TPH (JP5)	1,400	100 mg/m3
NASF-S3B /BMI031793-05	TPH (JP5)	1,500	100 mg/m3
NASF-S3A /BMI031793-06	TPH (JP5)	1,400	100 mg/m3

Note: Concentrations are based on 200 ml sample volumes at the temperature and pressure of the sampling location.

Approved by: Roger L. Scholl Date: 4/9/93
Roger L. Scholl, Ph.D.
Laboratory Director

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, Nevada 89431
Phone (702) 355-1044
Fax (702) 355-0406

CHAIN OF CUSTODY RECORD

Client Name	PO # 42880
Address 505 King Ave	Phone #
City, State, Zip Columbus, Ohio	Report Attention
Sampled by	

Time Sampled	Date Sampled	Type* See Key Below	Lab ID Number	Sample Description	Number of Containers	Analyses Required: TPH	Analyses Required: BTEX	Remarks
10:00	3/16/93	OT	NMSF-S1A	Soil Vapor 01	1	V		1 min Sample → 17°C
10:00	3/16/93	OT	NMSF-S1B	Soil Vapor 02	1	V		1 min Sample → 17°C
11:00	3/16/93	OT	NMSF-S2A	" 03	1	V		21°C
11:00	3/16/93	OT	NMSF-S2B	" 04	1	V		21°C
11:10	3/16/93	OT	NMSF-S3B	" 05	1	V		22°C
11:10	3/16/93	OT	NMSF-S3A	" 06	1	V		22°C
1:20	3/17/93	OT	SGP7-0.5	Soil Vapor 07	1		J	23°C (0.5 min)
1:20	3/17/93	OT	SGP7-1.0	" 08	1		J	23°C (1.0 min)
1:20	3/17/93	OT	SGP7-3.0	" 09	1		J	(3.0 min)
1:30	3/17/93	OT	SGP15-0.5	" 10	1		J	(0.5 min)
1:30	3/17/93	OT	SGP15-1.0	" 11	1		J	(1.0 min)
1:30	3/17/93	OT	SGP15-3.0	" 12	1		J	(3.0 min)

	Signature	Print Name	Company	Date	Time
Relinquished by		Jeffrey A. Kiehl	Battelle	3/17/93	4:00
Received by		Linda Lemke	Alpha Analytical	3/17/93	16:00
Relinquished by					
Received by					
Relinquished by					
Received by Laboratory					

Note
Samples are discarded 60 days after results are reported unless other arrangements are made. Hazardous samples will be returned to client or disposed of at client expense.

*Key: AQ - Aqueous SO - Soil WA - Waste OT - Other

APPENDIX B

BIOSLURPER SYSTEM OPERATION DATA SUMMARY

SYSTEM OPERATION DATA

Date	Vaccum (inhg)	Air Discharge Rate (scfm)	Water Discharged Daily (gal)	Water Discharged Total (gal)	Fuel Recovery Daily (gal)	Fuel Recovery Total (gal)
1/12/93	na	55	NA	1846	na	na
1/13/93	5	55	933	2779	na	na
1/14/93	3.5	55	876	3655	na	na
1/15/93	3	55	818	4473	na	na
1/16/93	4	54	577	5050	na	234.0
1/17/93	4	56	709	5759	na	na
1/18/93	3	57	446	6205	na	na
1/19/93	3	57	579	6784	na	348.4
1/20/93	3	56	359	7143	28.0	376.4
1/21/93	3	57	544	7687	25.6	402.0
			5841		**53.6**	
1/22/93	3	57	0	8042	29.5	431.5
1/23/93	3	56	427	8469	23.7	455.2
1/24/93	3	56	480	8949	33.8	489.0
1/25/93	3	57	530	9479	28.3	517.3
1/26/93	3	56	403	9882	25.4	542.7
1/27/93	3	57	391	10273	28.5	571.2
1/28/93	3	56	464	10737	25.4	596.6
			2695		**194.6**	
1/29/93	3	56	0	11303	28.7	625.4
1/30/93	0	58	21	11324	2.8	628.2
1/31/93	3	57	507	11831	34.5	662.7
2/1/93	0	58	430	12261	25.7	688.4
2/2/93	2	53	276	12537	21.9	710.3
2/3/93	0	58	452	12989	32.6	742.9
2/4/93	3	56	399	13388	17.3	760.2
			2085		**163.5**	
2/5/93	3	56	0	13700	27.8	788.0
2/6/93	3	56	261	13961	24.0	812.0
2/7/93	3	56	51	14012	31.6	843.6
2/8/93	3	55	346	14358	8.6	852.2
2/9/93	0	58	6	14364	2.5	854.7
2/10/93	2.5	55	509	14873	28.5	883.2
2/11/93	3	56	456	15329	25.0	908.2
			1629		**148**	
2/12/93	3	56	438	15767	21.9	930.1
2/13/93	3	56	417	16184	23.0	953.1
2/14/93	3	56	447	16631	23.6	976.7
2/15/93	3	56	431	17062	24.0	1000.7
2/16/93	3	57	427	17489	24.1	1024.8
2/17/93	3	57	452	17941	21.6	1046.4
2/18/93	3	56	434	18375	23.5	1069.9
			3046		**161.7**	
2/19/93	3	55	453	18828	21.9	1094.2
2/20/93	3	56	477	19305	23.4	1117.6
2/21/93	3	56	449	19754	21.6	1139.2
2/22/93	3	57	468	20222	23.7	1162.9
2/23/93	3	56	447	20669	24.4	1187.3
2/24/93	3	56	469	21138	22.7	1210.0
2/25/93	3	56	40	21178	4.4	1214.4
			2803		**142.1**	
2/26/93	3	56	580	21758	28.5	1242.9
2/27/93	3	57	486	22244	23.0	1265.9
2/28/93	3	57	462	22706	23.7	1289.6
3/1/93	3	56	443	23149	23.4	1313.0
3/2/93	3	56	466	23615	25.0	1338.0
3/3/93	3	56	407	24022	21.9	1359.9
3/4/93	3	56	461	24483	23.1	1383.0
			3305		**168.6**	
3/5/93	3	57	484	24967	24.7	1407.7
3/6/93	3	53	422	25389	21.3	1429.0
3/7/93	3	56	475	25864	22.9	1451.9
3/8/93	3	56	476	26340	23.7	1475.6
3/9/93	3	56	452	26792	23.9	1499.5
3/10/93	3	56	413	27205	21.6	1521.1
3/11/93	3	56	433	27638	21.3	1542.4
			3155		**159.4**	

SYSTEM OPERATION DATA

Date	Vaccum (inhg)	Air Discharge Rate (scfm)	Water Discharged Daily (gal)	Water Discharged Total (gal)	Fuel Recovery Daily (gal)	Fuel Recovery Total (gal)
	* system was shut down from 3/19 to 3/24 **** this data does NOT make sense					
3/25/93	4	48	1008	30712	129.1	1781.8
			1008		**129.1**	
3/26/93	4	–	848	31560	8.5	1790.3
3/27/93	4	50	696	32256	94.6	1884.9
3/28/93	4	–	675	32931	56.0	1940.9
3/29/93	4	50	526	33457	14.3	1955.2
3/30/93	4	52	561	34018		
3/31/93	4	–	602	34620	15.1	1970.3
4/1/93	4	–	770	35390	6.8	1977.1
			4678		**195.3**	
4/2/93	4	–	568	35958	44.2	2021.3
4/3/93	4	–	612	36570	47.8	2069.1
4/4/93	3	–	687	37257	49.7	2118.8
4/5/93	3.5	–	573	37830	14.2	2133.0
4/6/93	3	–	438	38268	9.0	2142.0
4/7/93	3.5	44	486	38754	9.4	2151.4
4/8/93	3	44	513	39267	6.8	2158.2
			3877		**181.1**	
4/9/93	3	44	492	39759	34.5	2192.7
4/10/93	* system was shut down from 3/19 to 3/24 **** this data does NOT make sense					
4/11/93	* system was shut down from 3/19 to 3/24 **** this data does NOT make sense					
4/12/93	4	48	1873	41632	62.7	2255.4
4/13/93	4	47	642	42274	25.5	2280.9
4/14/93	4	48	590	42864	12.9	2293.8
4/15/93	3.5	46	570	43434	11.8	2305.6
			4167		**147.4**	
4/16/93	3.5	46	610	44044	11.2	2316.8
4/17/93	3.5	46	589	44633	11.6	2328.4
4/18/93	3.5	46	541	45174	16.4	2344.8
4/19/93	3.5	46	98	45272	7.3	2352.1
4/20/93	3	44	574	45846	13.9	2366.0
4/21/93	3	42	444	46290	18.8	2384.8
4/22/93	3	42	499	46789	16.5	2401.3
			3355		**95.7**	
4/23/93	3.5	44	581	47370	16.8	2418.1
4/24/93	3.5	44	581	47951	19.9	2438.0
4/25/93	3.5	44	549	48500	16.7	2454.7
4/26/93	* system off for repairs					
4/27/93						
4/28/93	4	46	148	48648	7.4	2462.1
4/29/93	5	50	754	49402	14.1	2476.2
			2613		**74.9**	
4/30/93	4	47	784	50186	15.1	2491.4
5/1/93	4.5	48	700	50886	19.3	2510.7
5/2/93	4	46	644	51530	20.0	2530.7
5/3/93	*system off for repairs					
5/4/93	*system off for repairs					
5/5/93	4	46	711	52241	20.0	2550.7
5/6/93	3.5	44	476	52717	8.9	2559.6
			3315		**83.3**	
5/7/93	3.5	44	554	53271	12.4	2572.0
5/8/93	3.5	43	515	53786	13.7	2585.7
5/9/93	3.5	44	556	54342	12.5	2598.2
5/10/93	3	42	467	54809	11.0	2609.2
5/11/93	4	44	545	55354	9.7	2618.9
5/12/93	3.5	42	559	55913	11.2	2630.1
5/13/93	3.5	44	477	56390	8.7	2638.8
			3673		**79.2**	
5/14/93	3.5	–	520	56910	11.1	2649.9
5/15/93	4	–	656	57566	14.2	2664.1
5/16/93	4	–	498	58064	10.9	2675.0
5/17/93	4	–	588	58652	10.2	2685.2
5/18/93	4	–	485	59137	8.6	2693.8
5/19/93	*system off					
5/20/93	*system off					
			2747		**55**	

SYSTEM OPERATION DATA

Date		Vaccum (inhg)	Air Discharge Rate (scfm)	Water Discharged Daily (gal)	Water Discharged Total (gal)	Fuel Recovery Daily (gal)	Fuel Recovery Total (gal)
	System off from 5/19/93 to 6/2/93 for TRACER TEST						
6/3/93		7	48	185	59322	6.8	2700.6
6/4/93		4	46	910	60232	21.0	2721.6
6/5/93		4	47	733	60965	5.8	2727.4
				1828		**33.6**	
** system off 6/6/93 to 6/10/93							
6/11/93		4.5	46	935	61900	24.8	2752.2
6/12/93		3.5	46	612	62512	12.4	2764.6
6/13/93		3.5	42	458	62970	7.6	2772.2
6/14/93		3.5	42	462	63432	10.8	2783.0
6/15/93		4	45	503	63935	8.7	2791.7
6/16/93		4	44	536	64471	9.0	2800.7
				3506		**73.3**	
6/17/93		4	44	462	64933	5.8	2806.5
6/18/93		4	43	502	65435	9.1	2815.6
6/19/93		4	45	468	65903	5.5	2821.1
6/20/93		3.5	–	441	66344	3.2	2824.3
6/21/93		3.5	–	492	66836	6.9	2831.2
6/22/93		3.5	–	364	67200	15.8	2847.0
6/23/93		4	44	458	67658	4.5	2851.5
6/24/93		3.5	42	440	68098	5.2	2856.7
				3627		**56**	
6/25/93		4	46	520	68618	39.7	2896.4
6/26/93		3.5	--	442	69060	3.7	2900.1
6/27/93		3.5	--	499	69559	0.9	2901.0
6/28/93		3.5	--	455	70014	11.5	2912.5
6/29/93		4.5	--	555	70569	6.2	2918.7
6/30/93		4	--	656	71225	20.5	2939.2
7/1/93		3.5	--	519	71744	0.0	
				3646		**82.5**	
7/2/93		3.5	--	642	72386	26.6	2965.8
7/3/93		3.5	--	386	72772	4.9	2970.7
7/4/93		3	--	373	73145	5.9	2976.6
7/5/93		3.5	--	487	73632	6.2	2982.8
7/6/93		3.5	--	367	73999	4.3	2987.1
7/7/93		3.5	42	400	74399	3.2	2990.3
7/8/93		3.5	40	367	74766	1.3	2991.6
				3022		**52.4**	
7/9/93		3.5	40	336	75102	0.0	
7/10/93	* no servicing						
7/11/93	* no servicing						
7/12/93		3.5	40	1010	76112	296.9	3288.5
7/13/93		3.5	42	320	76432	9.1	3297.6
7/14/93		3.5	40	334	76766	5.9	3303.5
7/15/93		3	40	314	77080	2.4	3305.9
				2314		**314.3**	
7/16/93		3.5	–	263	77343	4.0	3309.9
7/17/93		3.5	–	162	77505	4.3	3314.2
7/18/93		3	–	–	–	3.5	3317.7
7/19/93		3.5	–	–	–	4.5	3322.2
7/20/93		3.5	–	–	–	1.3	3323.5
7/21/93	* System off						
7/22/93	* System started / no servicing data						
7/23/93	* no servicing data						
7/24/93		5	–	–	–	23.4	3346.9
7/25/93	* no servicing data						
7/26/93		6.5	–	–	–	6.6	3353.5
7/27/93	* System Down for Repairs	6.5				2.6	3356.1
7/29/93		5.5	–	–	–	12.4	3368.5
				425		**62.6**	

SYSTEM OPERATION DATA

Date		Vaccum (inhg)	Air Discharge Rate (scfm)	Water Discharged Daily (gal)	Water Discharged Total (gal)	Fuel Recovery Daily (gal)	Fuel Recovery Total (gal)
8/6/93	* System off – no servicing						
8/7/93		4.5	–	720	78225	6.8	3421.7
8/8/93	* No servicing						
8/9/93		4	–	480	78705	13.5	3439.5
8/10/93		5	–	420	79125	3.4	3442.9
8/11/93		5	–	480	79605	4.8	3444.4
8/12/93		5	–	480	80085	7.2	3451.6
				2580		**35.7**	
8/13/93		4	–	272	80357	4.1	3455.7
8/14/93		4	–	365	80722	3.5	3459.3
8/15/93	* No servicing						
8/16/93		4	–	906	81628	9.7	3469.0
8/17/93	* System off						
8/18/93	* System off						
8/19/93	* System off						
				1543		**17.3**	
8/20/93	* System off						
8/21/93		4	–	550	82178	7.0	3476.1
8/22/93		3.5	–	385	82563	6.2	3482.3
8/23/93		3.5	–	422	82985	5.5	3487.8
8/24/93		4	–	364	83349	6.3	3494.1
8/25/93		4	–	374	83723	4.7	3498.8
8/26/93		5	–	373	84096	5.3	3504.1
				2468		**35**	
8/27/93		7.5	–	435	84531	4.4	3508.6
8/28/93		8.5	–	1044	85575	17.5	3526.1
8/29/93	* No servicing						
8/30/93		5.5	–	1305	86880	44.2	3570.3
8/31/93		4.5	–	402	87282	16.3	3586.3
9/1/93		4.5	–	511	87793	22.2	3608.8
9/2/93		10.5	–	1220	89013	50.3	3659.2
				4917		**154.9**	
9/3/93		4.5	–	1017	90030	27.4	3686.6
9/4/93		8.5	–	370	90400	6.7	3693.3
9/5/93	* No servicing						
9/6/93	* No servicing						
9/7/93		5.5	–	2273	92673	59.1	3752.3
9/8/93		7	–	656	93329	16.7	3769.0
9/9/93		6	–	258	93587	5.2	3774.2
				4574		**115.1**	
9/10/93		9.5	–	768	94355	19.8	3794.0
9/11/93		4.5	–	625	94980	18.7	3812.8
9/12/93		10.5	–	1205	96185	34.5	3847.3
9/13/93		11.5	–	1355	97540	45.6	3892.9
9/14/93		9.5	–	1380	98920	29.0	3921.9
9/15/93		8	–	755	99675	32.6	3954.6
9/16/93		4.5	–	221	99896	6.7	3961.3
				6309		**186.9**	
9/17/93		7.5	–	275	100171	22.5	3983.8
9/18/93		11	–	1749	101920	41.0	4024.8
9/19/93		11	–	1951	103871	28.0	4052.8
9/20/93		8	–	1709	105580	39.6	4092.5
9/21/93		8.5	–	1985	107565	55.4	4147.9
9/22/93		8.5	–	1954	109519	46.1	4194.0
9/23/93		8	–	2034	111553	60.0	4254.1
				11657		**292.6**	
9/24/93		9	–	1676	113229	66.7	4320.8
9/25/93		10.5	–	1712	114941	51.4	4372.2
9/26/93		8.5	–	1706	116647	62.8	4435.1
9/27/93		10	–	1680	118327	26.6	4461.7
9/28/93		8.5	–	1097	119424	61.5	4523.7
9/29/93		10.5	–	2166	121590	43.1	4566.3
9/30/93		10.5	–	1757	123347	39.4	4605.7
				11794		**351.5**	

SYSTEM OPERATION DATA

Date		Vaccum (inhg)	Air Discharge Rate (scfm)	Water Discharged Daily (gal)	Water Discharged Total (gal)	Fuel Recovery Daily (gal)	Fuel Recovery Total (gal)
10/1/93		10	–	2048	125395	55.5	4661.2
10/2/93		9.5	–	1415	126810	32.8	4694.0
10/3/93	* No servicing						
10/4/93		10.5	–	3236	130046	71.1	4765.1
10/5/93		9.5	–	1839	131885	31.1	4797.2
10/6/93		9.5	–	1572	133457	16.6	4813.8
10/7/93		9.5	–	1598	135055	28.7	4842.6
				11708		**235.8**	
10/8/93		10	–	2210	89090	56.0	4898.6
10/9/93		10	–	1540	90630	27.1	4925.7
10/10/93	* No servicing						
10/11/93		8	–	2998	93628	39.4	4965.1
10/12/93		7.5	–	1542	95170	35.2	5000.3
10/13/93		9.5	–	1285	96455	17.2	5017.5
10/14/93		7	–	524	96979	41.1	5058.6
				10099		**216**	
10/15/93		4.5	–	159	97138	9.4	5068.1
10/16/93		5.5	–	40	97178	2.0	5070.1
10/17/93	Intermittent Operation						
10/18/93	Intermittent Operation						
10/19/93	Intermittent Operation						
10/20/93	Intermittent Operation						
10/21/93	Intermittent Operation						
10/22/93	Intermittent Operation						
10/23/93		6.5	–	641	97819	28.4	5098.6
10/24/93	No servicing – Lost suction/flow						
				840		**39.8**	
10/25/93	System Off						
10/26/93	System Off						
10/27/93	System Off						
10/28/93	System Off						
10/29/93	System Off						
10/30/93	System Off						
10/31/93	System Off						
11/1/93	System Off						
11/2/93	System Off						
				0		**0**	
11/4/93		5	–	996	98815		5179.7
11/5/93		6	–	556	99371		5179.7
11/6/93		5		574	99945	9.2	5188.9
11/7/93	* No servicing						
11/8/93		5	–	1551	101496	0.4	5189.3
11/9/93		6	–	992	102488		5189.3
11/10/93		5.5	–	1047	103535	7.2	5196.6
11/11/93		6	–	955	104490	6.5	5203.1
				6671		**23.3**	
11/12/93		7	–	764	105254	3.1	5206.2
11/13/93		6.5	–	426	105680	2.5	5208.7
11/14/93	* No servicing						
11/15/93		11	–	1200	106880	0.2	5208.9
11/16/93		5	–	1290	108170	10.1	5219.0
11/17/93		5	–	995	109165	24.8	5243.8
11/18/93		5	–	990	110155	17.5	5261.4
				5665		**58.2**	
11/19/93		5	–	1035	111190	20.6	5282.1
11/20/93		5	–	865	112055	16.6	5298.7
11/21/93	* No servicing						
11/22/93		5	–	1987	114042	43.6	5342.3
11/23/93		5	–	843	114885	14.5	5356.8
11/24/93		5	–	728	115613	23.3	5380.1
				5458		**118.6**	
11/25/93	* No servicing						
11/26/93	* No servicing						
11/27/93	* No servicing						
11/28/93	* No servicing						
				0		**0**	
11/29/93		6	–	3892	119505	103.1	5483.2

SYSTEM OPERATION DATA

Date		Vaccum (inhg)	Air Discharge Rate (scfm)	Water Discharged Daily (gal)	Water Discharged Total (gal)	Fuel Recovery Daily (gal)	Fuel Recovery Total (gal)
11/30/93		6	–	847	120352	22.6	5505.7
12/1/93		6	–	868	121220	20.4	5526.1
12/2/93		9	–	810	122030	18.4	5544.5
				6417		**164.5**	
12/3/93		10	–	905	122935	61.4	5605.9
12/4/93		9	–	823	123758	45.5	5651.4
12/5/93	* No servicing						
12/6/93		12	–	1179	124937	64.0	5715.5
12/7/93		9	–	1083	126020	44.7	5760.1
12/8/93		8	–	917	126937	38.0	5798.2
12/9/93		8	–	863	127800	37.9	5836.1
				5770		**291.5**	
12/10/93		11	–	948	128748	40.4	5876.6
12/11/93		10	–	857	129605	29.3	5905.9
12/12/93	* No servicing						
12/13/93		9	–	1363	130968	86.4	5992.1
12/14/93		10	–	747	131715	41.7	6033.9
12/15/93		5	–	767	132482	27.1	6061.0
12/16/93		7	–	446	132928	35.4	6096.4
				5128		**260.3**	
12/17/93		7	–	827	133755	81.6	6178.1
12/18/93		7	–	713	134468	48.6	6226.7
12/19/93	* No servicing						
12/20/93			–	1157	135625	65.2	6291.9
12/21/93			–	90	135715	0.0	6291.9
12/22/93	* System Off / frozen						
12/23/93	* No readings taken						
12/24/93		9	–	113	135828	13.6	6305.5
				2900		**209**	
12/25/93	* No servicing						
12/26/93		9	–	157	135985	1.1	6306.6
12/27/93		8	–	880	136865	33.1	6339.7
12/28/93		7	–	855	137720	42.7	6382.5
12/29/93		7	–	960	138680	33.7	6416.2
12/30/93		7	–	835	139515	27.4	6443.6
12/31/93		8	–	740	140255	25.3	6468.9
				4427		**163.3**	

APPENDIX C

BIOSLURPER EFFLUENT DISCHARGE DATA

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, Nevada 89431
(702) 355-1044
FAX: 702-355-0406
1-800-283-1183

Boise, Idaho
(208) 336-4145

2810 W. Charleston, Suite G67
Las Vegas, Nevada 89102
(702) 386-6747

ANALYTICAL REPORT

Battelle
505 King Ave
Columbus Ohio 43201

Job#:
Phone: (614) 424-6122
Attn: Jeff Kittel

Sampled: 02/03/93 Received: 02/03/93 Analyzed: 02/16/93

Matrix: [ ] Soil [X] Water [ ] Waste

Analysis Requested: TPH - Total Petroleum Hydrocarbons-Extractable Quantitated As Diesel

Methodology: TPH - Modified 8015/DHS LUFT Manual

Results:

Client ID/ Lab ID	Parameter	Concentration mg/L	Detection Limit mg/L
FNAS-E8 /BMI020393-01	TPH *	55	0.5

* - TPH components are in the range of JP5, diesel #1, and kerosene.

Approved by: Roger L. Scholl Date: 2/18/93
Roger L. Scholl, Ph.D.
Laboratory Director

CHEMAX Laboratories, Inc.

Analytical and Environmental Chemists
EPA Lab ID #NV004

(702) 355-0202
FAX (702) 355-0817

LABORATORY REPORT

Report To: Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, NV 89431

Lab Report No.: 9409
Account No.: ALPHA

Telephone: 355-1044

Fax: 355-0406

Work Authorized By: Randy Gardner
Date Sampled: 02/03/93
Number of Samples: 1
Source: FNAS-E8
Chemax Control No. 93-0548
Notes:

Date Submitted: 02/04/93
Sampled By: Client
Your Reference: BMI020393

Parameter	Result
pH	8.89

Remarks:

Analysis By: Graves

Date: 02/04/93

Approved By: Colin A. Letteri

Date: 02/08/93

Page 1 of 1

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(208) 336-4145

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Las Vegas, Nevada 89102
(702) 386-6747

ANALYTICAL REPORT

Battelle
505 King Ave
Columbus Ohio 43201

Job#:
Phone: (614) 424-6122
Attn: Jeff Kittel

Sampled: 03/03/93 Received: 03/03/93 Analyzed: 03/15/93

Matrix: [ ] Soil [X] Water [ ] Waste

Analysis Requested: TPH - Total Petroleum Hydrocarbons-Extractable Quantitated As Diesel

Methodology: TPH - Modified 8015/DHS LUFT Manual

Results:

Client ID/ Lab ID	Parameter	Concentration mg/L	Detection Limit mg/L
FNAS-E9 /BMI030393-01	TPH *	46	0.5

* - TPH components are in the range of JP5, jet A, diesel #1, and kerosene.

Approved by: Roger L. Scholl Date: 3/18/93
Roger L. Scholl, Ph.D.
Laboratory Director

CHEMAX Laboratories, Inc.

Analytical and Environmental Chemists
EPA Lab ID #NV004

(702) 355-0202
FAX (702) 355-0817

LABORATORY REPORT

Report To: Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, NV 89431

Lab Report No.: 9564
Account No.: ALPHA

Telephone: 355-1044

Fax: 355-0406

Work Authorized By: Randy Gardner
Date Sampled: 03/03/93
Number of Samples: 1
Source:
Chemax Control No. 93-1108
Notes:

Date Submitted: 03/03/93
Sampled By: Client
Your Reference: BMI030393-01

Parameter	Result
pH	8.88

Remarks:

Analysis By: Nannini

Date: 03/04/93

Approved By:

Date: 03/11/93

992 Spice Islands Drive, Sparks, Nevada 89431 • P.O. Box 21122, Reno, Nevada 89515

Alpha Analytical, Inc.
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Boise, Idaho
(208) 336-4145

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Las Vegas, Nevada 89102
(702) 386-6747

ANALYTICAL REPORT

Battelle
505 King Ave
Columbus Ohio 43201

Job#:
Phone: (614) 424-6122
Attn: Jeff Kittel

Sampled: 04/07/93 Received: 04/07/93 Analyzed: 04/20/93

Matrix: [ ] Soil [X] Water [ ] Waste

Analysis Requested: TPH - Total Petroleum Hydrocarbons-Extractable Quantitated As Diesel

Methodology: TPH - Modified 8015/DHS LUFT Manual

Results:

Client ID/ Lab ID	Parameter	Concentration mg/L	Detection Limit mg/L
FNAS-E10 /BMI040793-01	TPH *	85	2.5

* - TPH components are in the range of JP5, kerosene and diesel #1.

Approved by: Roger L. Scholl Date: 4/26/93
Roger L. Scholl, Ph.D.
Laboratory Director

CHEMAX Laboratories, Inc.

Analytical and Environmental Chemists
EPA Lab ID #NV004

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LABORATORY REPORT

Report To: Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, NV 89431

Lab Report No.: 9734
Account No.: ALPHA

Telephone: 355-1044

Fax: 355-0406

Work Authorized By: Randy Gardner
Date Sampled: 04/07/93
Number of Samples: 1
Source: FNAS-E10
Chemax Control No. 93-1878
Notes:

Date Submitted: 04/07/93
Sampled By: Client
Your Reference: BMI040793

Parameter	Result
pH	8.81

Remarks:

Analysis By: Graves

Date: 04/08/93

Approved By: Colin A. Letteri

Date: 04/12/93

Page 1 of 1

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ANALYTICAL REPORT

Battelle
505 King Ave
Columbus Ohio 43201

Job#:
Phone: (614) 424-6122
Attn: Jeff Kittel

Sampled: 05/05/93 Received: 05/05/93 Analyzed: 05/21/93

Matrix: [ ] Soil [X] Water [ ] Waste

Analysis Requested: TPH - Total Petroleum Hydrocarbons-Extractable Quantitated As Diesel

Methodology: TPH - Modified 8015/DHS LUFT Manual

Results:

Client ID/ Lab ID	Parameter	Concentration mg/L	Detection Limit mg/L
FNAS-E11 /BMI050593-01	TPH *	150	5

* - TPH components are in the range of JP5 and diesel #1

Approved by: Roger L. Scholl Date: 5/21/93
Roger L. Scholl, Ph.D.
Laboratory Director

CHEMAX Laboratories, Inc.

Analytical and Environmental Chemists
EPA Lab ID #NV004

(702) 355-0202
FAX (702) 355-0817

LABORATORY REPORT

Report To: Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, NV 89431

Lab Report No.: 9881
Account No.: ALPHA

Telephone: 355-1044

Fax: 355-0406

Work Authorized By: Randy Gardner
Date Sampled: 05/05/93
Number of Samples: 1
Source: FNAS-E11
Chemax Control No. 93-2792
Notes:

Date Submitted: 05/06/93
Sampled By: Client
Your Reference: BMI050593

Parameter	Result
pH	8.95

Remarks:

Analysis By: Graves

Date: 05/07/93

Approved By: Colin A. Lettice

Date: 05/11/93

Page 1 of 1

Alpha Analytical, Inc.
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(208) 336-4145

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ANALYTICAL REPORT

Battelle
505 King Ave
Columbus Ohio 43201

Job#:
Phone: (614) 424-6122
Attn: Jeff Kittel

Sampled: 06/15/93 Received: 06/15/93 Analyzed: 06/24/93

Matrix: [ ] Soil [X] Water [ ] Waste

Analysis Requested: TPH - Total Petroleum Hydrocarbons-Extractable Quantitated As Diesel

Methodology: TPH - Modified 8015/DHS LUFT Manual

Results:

Client ID/ Lab ID	Parameter	Concentration mg/L	Detection Limit mg/L
FNAS E12 /BMI061593-01	TPH *	130	5

* - TPH components are in the range of JP5, kerosene and diesel #1.

Approved by: Roger L. Scholl Date: 6/29/93
Roger L. Scholl, Ph.D.

CHEMAX Laboratories, Inc.
Analytical and Environmental Chemists
EPA Lab ID #NV004
(702) 355-0202
FAX (702) 355-0817

LABORATORY REPORT

Report To: Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, NV 89431

Lab Report No.: 10065
Account No.: ALPHA

Telephone: 355-1044

Fax: 355-0406

Work Authorized By: Randy Gardner
Date Sampled: 06/15/93
Number of Samples: 1
Source: Unknown
Chemax Control No. 93-4165
Notes:

Date Submitted: 06/15/93
Sampled By: Client
Your Reference: BMI061593-01

Parameter	Result
pH	8.81

Remarks:

Analysis By: Szeto

Approved By: Colin A. Lettice

Date: 06/16/93

Date: 06/16/93

Page 1 of 1

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
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1-800-283-1183

Boise, Idaho
(208) 336-4145

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Las Vegas, Nevada 89102
(702) 386-6747

ANALYTICAL REPORT

Battelle
505 King Ave
Columbus Ohio 43201

Job#:
Phone: (614) 424-6122
Attn: Jeff Kittel

Sampled: 07/09/93 Received: 07/09/93 Analyzed: 07/23/93

Matrix: [ ] Soil [X] Water [ ] Waste

Analysis Requested: TPH - Total Petroleum Hydrocarbons-Extractable Quantitated As Diesel

Methodology: TPH - Modified 8015/DHS LUFT Manual

Results:

Client ID/ Lab ID	Parameter	Concentration mg/L	Detection Limit mg/L
FNASE-13 /BMI070993-01	TPH *	97	0.5

* - TPH components are in the range of JP5 and diesel #1.

Approved by: Walter J. Hinchman Date: 7/26/93
Walter Hinchman
Quality Control Officer

CHEMAX Laboratories, Inc.

Analytical and Environmental Chemists

(702) 355-0202
FAX (702) 355-0817

EPA Lab ID #NV004

LABORATORY REPORT

Report To: Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, NV 89431

Lab Report No.: 10196
Account No.: ALPHA

Telephone: 355-1044

Fax: 355-0406

Work Authorized By: Randy Gardner
Date Sampled: 07/09/93
Number of Samples: 1
Source: FNASE-13
Chemax Control No. 93-4684
Notes:

Date Submitted: 07/09/93
Sampled By: Client
Your Reference: BMI070993

Parameter	Results
pH	8.87

Remarks:

Analysis By: Shen

Date: 07/09/93

Approved By: Colin A. Lettice

Date: 07/12/93

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(702) 386-6747

ANALYTICAL REPORT

Battelle
505 King Ave
Columbus Ohio 43201

Job#:
Phone: (614) 424-6122
Attn: Jeff Kittel

Sampled: 08/06/93 Received: 08/06/93 Analyzed: 08/18/93

Matrix: [ ] Soil [X] Water [ ] Waste

Analysis Requested: TPH - Total Petroleum Hydrocarbons-Extractable Quantitated As Diesel

Methodology: TPH - Modified 8015/DHS LUFT Manual

Results:

Client ID/ Lab ID	Parameter	Concentration mg/L	Detection Limit mg/L
FNAS-E14 /BMI080693-01	TPH *	30	0.5

* - TPH components are in the range of JP5, kerosene and diesel #1.

Approved by: Roger L. Scholl Date: 8/18/93
Roger L. Scholl, Ph.D.
Laboratory Director

CHEMAX Laboratories, Inc.

Analytical and Environmental Chemists
EPA Lab ID #NV004

(702) 355-0202
FAX (702) 355-0817

LABORATORY REPORT

Report To: Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, NV 89431

Lab Report No.: 10328
Account No.: ALPHA

Telephone: 355-1044

Fax: 355-0406

Work Authorized By: Randy Gardner
Date Sampled: 08/06/93
Number of Samples: 1
Source: FNAS-E14
Chemax Control No. 93-5487
Notes:

Date Submitted: 08/06/93
Sampled By: Client
Your Reference: BMI080693

Parameter	Results
pH	9.00

Remarks:

Analysis By: Shen

Date: 08/06/93

Approved By: Colin A. Lettice

Date: 08/09/93

992 Spice Islands Drive, Sparks, Nevada 89431 • P.O. Box 21122, Reno, Nevada 89515

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, Nevada 89431
(702) 355-1044
FAX: 702-355-0406
1-800-283-1183

Boise, Idaho
(208) 336-4145

2810 W. Charleston. Suite G67
Las Vegas. Nevada 89102
(702) 386-6747

ANALYTICAL REPORT

Battelle
505 King Ave
Columbus Ohio 43201

Job#:
Phone: (614) 424-6122
Attn: Jeff Kittel

Sampled: 09/09/93 Received: 09/09/93 Analyzed: 09/23/93

Matrix: [ ] Soil [X] Water [ ] Waste

Analysis Requested: TPH - Total Petroleum Hydrocarbons-Extractable Quantitated As Diesel

Methodology: TPH - Modified 8015/DHS LUFT Manual

Results:

Client ID/ Lab ID	Parameter	Concentration mg/L	Detection Limit mg/L
FNAS-E15 /BMI090993-01	TPH *	40	0.5

* - TPH components are in the range of JP5 and kerosene.

Approved by: Roger L. Scholl Date: 9/24/93
Roger L. Scholl, Ph.D.
Laboratory Director

CHEMAX Laboratories, Inc.

Analytical and Environmental Chemists
EPA Lab ID #NV004

(702) 355-0202
FAX (702) 355-0817

LABORATORY REPORT

Report To: Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, NV 89431

Lab Report No.: 10525
Account No.: ALPHA

Telephone: 355-1044

Fax: 355-0406

Work Authorized By: Randy Gardner
Date Sampled: 09/09/93
Number of Samples: 1
Source: Unknown
Chemax Control No. 93-6546
Notes:

Date Submitted: 09/09/93
Sampled By: Client
Your Reference: BMI090993-01

Parameter	Results
pH	8.97

Remarks:

Analysis By: Eckert

Date: 09/09/93

Approved By: Colin A. Letts

Date: 09/10/93

992 Spice Islands Drive, Sparks, Nevada 89431 • P.O. Box 21122, Reno, Nevada 89515

Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, Nevada 89431
(702) 355-1044
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1-800-283-1183

Boise, Idaho
(208) 336-4145

2810 W. Charleston, Suite G67
Las Vegas, Nevada 89102
(702) 386-6747

ANALYTICAL REPORT

Battelle
505 King Ave
Columbus Ohio 43201

Job#:
Phone: (614) 424-6122
Attn: Jeff Kittel

Sampled: 10/08/93 Received: 10/08/93 Analyzed: 10/13/93

Matrix: [ ] Soil [X] Water [ ] Waste

Analysis Requested: TPH - Total Petroleum Hydrocarbons-Extractable Quantitated As Diesel

Methodology: TPH - Modified 8015/DHS LUFT Manual

Results:

Client ID/ Lab ID	Parameter	Concentration mg/L	Detection Limit mg/L
FNAS-E16 /BMI100893-01	TPH *	210	0.5

* - TPH components are in the range of JP5 and kerosene.

Approved by: Roger L. Scholl Date: 10/18/93
Roger L. Scholl, Ph.D.
Laboratory Director

CHEMAX Laboratories, Inc.

Analytical and Environmental Chemists
EPA Lab ID #NV004

(702) 355-0202
FAX (702) 355-0817

LABORATORY REPORT

Report To: Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, NV 89431

Lab Report No.: 10682
Account No.: ALPHA

Telephone: 355-1044

Fax: 355-0406

Work Authorized By: Randy Gardner
Date Sampled: 10/08/93
Number of Samples: 1
Source: FNAS E16
Chemax Control No. 93-7446
Notes:

Date Submitted: 10/11/93
Sampled By: Client
Your Reference: BMI100893-01

Parameter	Results
pH	8.82

Remarks:

Analysis By: Szeto

Date: 10/11/93

Approved By: Colin A. Lettieri

Date: 10/12/93

992 Spice Islands Drive, Sparks, Nevada 89431 • P.O. Box 21122, Reno, Nevada 89515

Alpha Analytical, Inc.
255 Glendale Avenue. Suite 21
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(702) 355-1044
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Boise. Idaho
(208) 336-4145

2810 W. Charleston. Suite G67
Las Vegas. Nevada 89102
(702) 386-6747

ANALYTICAL REPORT

Battelle
505 King Ave
Columbus Ohio 43201

Job#: 67490
Phone: (614) 424-6122
Attn: Jeff Kittel

Sampled: 12/09/93 Received: 12/09/93 Analyzed: 12/15/93

Matrix: [ ] Soil [X] Water [ ] Waste

Analysis Requested: TPH - Total Petroleum Hydrocarbons-Extractable Quantitated As Diesel

Methodology: TPH - Modified 8015/DHS LUFT Manual

Results:

Client ID/ Lab ID	Parameter	Concentration mg/L	Detection Limit mg/L
FNAS-E-18 /BMI120993-01	TPH *	200	5

* - TPH components are in the range of JP5, kerosene and diesel #1.

Approved by: Roger L. Scholl Date: 12/15/93
Roger L. Scholl, Ph.D.
Laboratory Director

CHEMAX Laboratories, Inc.

Analytical and Environmental Chemists
EPA Lab ID #NV004

(702) 355-0202
FAX (702) 355-0817

LABORATORY REPORT

Report To: Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, NV 89431

Lab Report No.: 11008
Account No.: ALPHA

Telephone: 355-1044

Fax: 355-0406

Work Authorized By: Randy Gardner
Date Sampled: 12/09/93
Number of Samples: 1
Source: FNAS-E-18
Chemax Control No. 93-8938
Notes:

Date Submitted: 12/09/93
Sampled By: Client
Your Reference: BMI120993

Parameter	Results
pH	8.77

Remarks:

Analysis By: Eckert

Date: 12/09/93

Approved By: Colin A. Zettle

Date: 12/14/93

Page 1 of 1

APPENDIX D

GROUNDWATER LEVEL AND FREE PRODUCT THICKNESS DATA FOR SITE MONITORING WELLS

MONITORING WELL MEASUREMENTS (ft)

		A			B			C			D			E			F			G		
Date	Cum. Days	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness
1/12/93	0	7.10	9.75	2.65	7.30	9.80	2.50	na	na	0.00	na	na	0.00	10.20	12.40	2.20	na	na	0.00	na	na	0.00
1/13/93	1	7.10	9.80	2.70	7.25	9.70	2.45	na	na	0.00	na	9.35	0.00	10.50	13.00	2.50	na	na	0.00	na	na	0.00
1/14/93	2	7.10	9.73	2.63	7.25	9.77	2.52	na	na	0.00	na	9.30	0.00	10.60	13.15	2.55	na	na	0.00	na	na	0.00
1/15/93	3	7.12	9.78	2.66	7.27	9.86	2.59	9.10	11.18	2.08	na	9.37	0.00	10.64	13.13	2.49	na	na	0.00	na	na	2.49
1/18/93	6	7.15	9.70	2.55	7.25	9.80	2.55	9.10	11.10	2.00	na	9.35	0.00	10.70	12.90	2.20	na	na	0.00	na	na	0.00
1/19/93	7	7.15	8.70	1.55	7.30	9.80	2.50	9.10	11.30	2.20	na	9.35	0.00	10.70	13.10	2.40	na	na	0.00	na	na	0.00
1/20/93	8	7.15	9.20	2.05	7.30	9.80	2.50	9.10	11.20	2.10	na	9.30	0.00	10.60	12.60	2.00	na	na	0.00	na	na	0.00
1/21/93	9	na	na	na	7.30	9.80	2.50	9.10	11.30	2.20	na	9.35	0.00	10.70	13.10	2.40	na	na	0.00	na	na	0.00
1/22/93	10	na	na	na	7.60	8.40	0.80	9.10	11.30	2.20	na	9.40	0.00	10.70	12.90	2.20	na	na	0.00	na	na	0.00
1/23/93	11	na	na	na	7.50	8.50	1.00	9.15	11.20	2.05	na	9.35	0.00	10.70	12.90	2.20	na	na	0.00	na	na	0.00
1/24/93	12	na	na	na	7.50	8.50	1.00	9.15	11.25	2.10	na	9.35	0.00	10.70	12.90	2.20	na	na	0.00	na	na	0.00
1/25/93	13	na	na	na	7.50	8.65	1.15	9.15	11.30	2.15	na	9.30	0.00	10.70	12.80	2.10	na	na	0.00	na	na	0.00
1/26/93	14	na	na	na	7.50	8.80	1.30	9.15	11.15	2.00	na	9.30	0.00	10.60	12.80	2.20	na	na	0.00	na	na	0.00
1/27/93	15	na	na	na	7.40	8.85	1.45	9.15	11.20	2.05	na	9.30	0.00	10.75	12.90	2.15	na	na	0.00	na	na	0.00
1/28/93	16	na	na	na	7.40	8.95	1.55	9.15	11.20	2.05	na	9.30	0.00	10.70	12.90	2.20	na	na	0.00	na	na	0.00
1/29/93	17	na	na	na	7.40	9.05	1.65	9.15	11.10	1.95	na	9.30	0.00	10.75	12.90	2.15	na	na	0.00	na	na	0.00
1/30/93	18	na	na	na	7.30	9.10	1.80	9.15	11.15	2.00	na	9.25	0.00	10.60	12.50	1.90	na	na	0.00	na	na	0.00
1/31/93	19	na	na	na	7.35	9.20	1.85	9.15	11.15	2.00	na	9.25	0.00	10.75	12.80	2.05	na	na	0.00	na	na	0.00
2/1/93	20	na	na	na	7.30	9.20	1.90	9.15	11.15	2.00	na	9.25	0.00	10.70	12.70	2.00	na	na	0.00	na	na	0.00
2/2/93	21	na	na	na	7.30	9.30	2.00	9.15	11.10	1.95	na	9.30	0.00	10.70	12.80	2.10	na	na	0.00	na	na	0.00
2/3/93	22	na	na	na	7.30	9.30	2.00	9.10	11.15	2.05	na	9.20	0.00	10.70	12.70	2.00	na	na	0.00	na	na	0.00
2/4/93	23	na	na	na	7.30	9.35	2.05	9.15	11.10	1.95	na	9.25	0.00	10.60	12.70	2.10	na	na	0.00	na	na	0.00
2/5/93	24	7.20	8.90	1.70	7.25	9.35	2.10	9.15	11.05	1.90	na	9.25	0.00	10.70	12.70	2.00	na	na	0.00	na	na	0.00
2/6/93	25	7.20	9.00	1.80	7.25	9.35	2.10	9.15	11.05	1.90	na	9.20	0.00	10.75	12.80	2.05	na	na	0.00	na	na	0.00
2/7/93	26	7.20	9.00	1.80	7.25	9.35	2.10	9.15	11.05	1.90	na	9.20	0.00	10.75	12.80	2.05	na	na	0.00	na	na	0.00
2/8/93	27	7.20	9.10	1.90	7.20	9.35	2.15	9.10	10.95	1.85	na	9.15	0.00	10.70	12.70	2.00	na	na	0.00	na	na	0.00
2/9/93	28	7.15	9.10	1.95	7.20	9.40	2.20	9.10	11.00	1.90	na	9.20	0.00	10.50	12.35	1.85	na	na	0.00	na	na	0.00
2/10/93	29	7.10	9.10	2.00	7.25	9.45	2.20	9.10	11.05	1.95	na	9.25	0.00	10.70	12.70	2.00	na	na	0.00	na	na	0.00
2/11/93	30	7.15	9.00	1.85	7.20	9.45	2.25	9.10	10.95	1.85	na	9.20	0.00	10.75	12.70	1.95	na	na	0.00	na	na	0.00
2/12/93	31	7.15	9.15	2.00	7.25	9.45	2.20	9.15	11.00	1.85	na	9.25	0.00	10.75	12.75	2.00	na	na	0.00	na	na	0.00
2/13/93	32	7.15	9.15	2.00	7.25	9.45	2.20	9.15	11.00	1.85	na	9.20	0.00	10.75	12.75	2.00	na	na	0.00	na	na	0.00
2/14/93	33	7.15	9.15	2.00	7.20	9.45	2.25	9.15	10.95	1.80	na	9.20	0.00	10.75	12.70	1.95	na	na	0.00	na	na	0.00

na: no sample available

MONITORING WELL MEASUREMENTS (ft)

		A			B			C			D			E			F			G		
Date	Cum. Days	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness
2/15/93	34	7.15	9.15	2.00	7.20	9.45	2.25	9.10	10.90	1.80	na	9.15	0.00	10.70	12.60	1.90	na	na	0.00	na	na	0.00
2/16/93	35	7.15	9.15	2.00	7.20	9.45	2.25	9.15	10.90	1.75	na	9.20	0.00	10.80	12.70	1.90	na	na	0.00	na	na	0.00
2/17/93	36	7.15	9.20	2.05	7.20	9.45	2.25	9.15	10.90	1.75	na	9.20	0.00	10.75	12.75	2.00	na	na	0.00	na	na	0.00
2/18/93	37	7.15	9.20	2.05	7.20	9.45	2.25	9.15	10.90	1.75	na	9.15	0.00	10.75	12.70	1.95	na	na	0.00	na	na	0.00
2/19/93	38	7.15	9.20	2.05	7.20	9.40	2.20	9.10	10.90	1.80	na	9.20	0.00	10.75	12.65	1.90	na	na	0.00	na	na	0.00
2/20/93	39	7.15	9.20	2.05	7.20	9.45	2.25	9.10	10.90	1.80	na	9.20	0.00	10.75	12.65	1.90	na	na	0.00	na	na	0.00
2/21/93	40	7.15	9.20	2.05	7.20	9.45	2.25	9.15	10.95	1.80	na	9.20	0.00	10.75	12.65	1.90	na	na	0.00	na	na	0.00
2/22/93	41	7.15	9.20	2.05	7.20	9.45	2.25	9.15	10.90	1.75	na	9.25	0.00	10.80	12.80	2.00	na	na	0.00	na	na	0.00
2/23/93	42	7.15	9.20	2.05	7.20	9.40	2.20	9.15	10.85	1.70	na	9.20	0.00	10.80	12.75	1.95	na	na	0.00	na	na	0.00
2/24/93	43	7.15	9.25	2.10	7.20	9.40	2.20	9.15	10.85	1.70	na	9.20	0.00	10.80	12.85	2.05	na	na	0.00	na	na	0.00
2/25/93	44	7.15	9.20	2.05	7.20	9.40	2.20	9.15	10.85	1.70	na	9.20	0.00	10.55	12.35	1.80	na	na	0.00	na	na	0.00
2/26/93	45	7.15	9.25	2.10	7.20	9.40	2.20	9.15	10.85	1.70	na	9.20	0.00	10.75	12.70	1.95	na	na	0.00	na	na	0.00
2/27/93	46	7.15	9.25	2.10	7.20	9.45	2.25	9.15	10.85	1.70	na	9.20	0.00	10.75	12.70	1.95	na	na	0.00	na	na	0.00
2/28/93	47	7.15	9.25	2.10	7.20	9.45	2.25	9.15	10.85	1.70	na	9.20	0.00	10.80	12.75	1.95	na	na	0.00	na	na	0.00
3/1/93	48	7.15	9.25	2.10	7.20	9.45	2.25	9.15	10.90	1.75	na	9.25	0.00	10.80	12.75	1.95	na	na	0.00	na	na	0.00
3/2/93	49	7.15	9.25	2.10	7.20	9.45	2.25	9.15	10.85	1.70	na	9.20	0.00	10.80	12.70	1.90	na	na	0.00	na	na	0.00
3/3/93	50	7.15	9.25	2.10	7.20	9.45	2.25	9.15	10.85	1.70	na	9.20	0.00	10.80	12.70	1.90	na	na	0.00	na	na	0.00
3/4/93	51	7.15	9.25	2.10	7.20	9.45	2.25	9.20	10.90	1.70	na	9.25	0.00	10.85	12.75	1.90	na	na	0.00	na	na	0.00
3/5/93	52	7.15	9.30	2.15	7.20	9.45	2.25	9.20	10.90	1.70	na	9.25	0.00	10.80	12.70	1.90	na	na	0.00	na	na	0.00
3/6/93	53	7.15	9.30	2.15	7.20	9.45	2.25	9.20	10.85	1.65	na	9.25	0.00	10.80	12.75	1.95	na	na	0.00	na	na	0.00
3/7/93	54	7.15	9.30	2.15	7.20	9.40	2.20	9.15	10.85	1.70	na	9.20	0.00	10.80	12.70	1.90	na	na	0.00	na	na	0.00
3/8/93	55	7.15	9.30	2.15	7.20	9.40	2.20	9.15	10.80	1.65	na	9.20	0.00	10.85	12.70	1.85	na	na	0.00	na	na	0.00
3/9/93	56	7.15	9.30	2.15	7.20	9.40	2.20	9.15	10.80	1.65	na	9.20	0.00	10.80	12.65	1.85	na	na	0.00	na	na	0.00
3/10/93	57	7.15	9.30	2.15	7.20	9.35	2.15	9.15	10.80	1.65	na	9.20	0.00	10.85	12.65	1.80	na	na	0.00	na	na	0.00
3/11/93	58	7.15	9.30	2.15	7.20	9.35	2.15	9.20	10.80	1.60	na	9.20	0.00	10.85	12.65	1.80	na	na	0.00	na	na	0.00
3/12/93	59	7.15	9.30	2.15	7.20	9.40	2.20	9.20	10.80	1.60	na	9.20	0.00	10.85	12.70	1.85	na	na	0.00	na	na	0.00
3/13/93	60	7.15	9.30	2.15	7.20	9.35	2.15	9.20	10.75	1.55	na	9.20	0.00	10.80	12.70	1.90	na	na	0.00	na	na	0.00
3/14/93	61	7.15	9.30	2.15	7.20	9.35	2.15	9.20	10.75	1.55	na	9.20	0.00	10.80	12.70	1.90	na	na	0.00	na	na	0.00
3/15/93	62	7.15	9.30	2.15	7.20	9.35	2.15	9.15	10.75	1.60	na	9.20	0.00	10.85	12.70	1.85	na	na	0.00	na	na	0.00
3/16/93	63	7.15	9.30	2.15	7.20	9.35	2.15	9.20	10.70	1.50	na	9.20	0.00	10.85	12.70	1.85	na	na	0.00	na	na	0.00
3/17/93	64	7.15	9.25	2.10	7.20	9.30	2.10	9.15	10.65	1.50	na	9.15	0.00	10.50	12.20	1.70	na	na	0.00	na	na	0.00
3/19/93	66	7.10	9.20	2.10	7.20	9.30	2.10	9.10	10.60	1.50	na	9.15	0.00	10.40	12.00	1.60	na	na	0.00	na	na	0.00

MONITORING WELL MEASUREMENTS (ft)

		A			B			C			D			E			F			G		
Date	Cum. Days	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness
3/20/93	67	7.10	9.20	2.10	9.20	9.30	0.10	9.10	10.60	1.50	na	9.15	0.00	10.40	12.00	1.60	na	na	0.00	na	na	0.00
3/21/93	68	7.10	9.15	2.05	7.15	9.25	2.10	9.10	10.60	1.50	na	9.20	0.00	10.35	11.95	1.60	na	na	0.00	na	na	0.00
3/22/93	69	7.10	9.15	2.05	7.15	9.25	2.10	9.10	10.60	1.50	na	9.20	0.00	10.35	11.90	1.55	na	na	0.00	na	na	0.00
3/23/93	70	7.10	9.10	2.00	7.15	9.30	2.15	9.10	10.60	1.50	na	9.15	0.00	10.30	11.90	1.60	na	na	0.00	na	na	0.00
3/25/93	72	7.10	9.10	2.00	7.15	9.20	2.05	9.10	10.60	1.50	na	9.15	0.00	11.00	12.70	1.70	na	na	0.00	na	na	0.00
3/26/93	73	na	na	0.00	7.15	9.20	2.05	9.15	10.65	1.50	na	9.15	0.00	10.85	12.95	2.10	na	na	0.00	na	na	0.00
3/27/93	74	na	na	0.00	7.15	9.15	2.00	9.15	10.70	1.55	na	9.15	0.00	11.00	12.95	1.95	na	na	0.00	na	na	0.00
3/28/93	75	na	na	0.00	7.15	9.20	2.05	9.15	10.75	1.60	na	9.15	0.00	11.00	13.00	2.00	na	na	0.00	na	na	0.00
3/29/93	76	na	na	0.00	7.15	9.20	2.05	9.15	10.75	1.60	na	9.15	0.00	11.00	13.00	2.00	na	na	0.00	na	na	0.00
3/30/93	77	na	na	0.00	7.15	9.20	2.05	9.15	10.75	1.60	na	9.15	0.00	11.00	13.00	2.00	na	na	0.00	na	na	0.00
3/31/93	78	na	na	0.00	7.10	9.15	2.05	9.15	10.70	1.55	na	9.15	0.00	11.00	13.00	2.00	na	na	0.00	na	na	0.00
4/1/93	79	na	na	0.00	7.10	9.15	2.05	9.15	10.70	1.55	na	9.10	0.00	11.00	13.00	2.00	na	na	0.00	na	na	0.00
4/2/93	80	na	na	0.00	7.10	9.15	2.05	9.15	10.75	1.60	na	9.15	0.00	11.00	13.00	2.00	na	na	0.00	na	na	0.00
4/3/93	81	na	na	0.00	7.10	9.15	2.05	9.15	10.70	1.55	na	9.10	0.00	11.00	13.00	2.00	na	na	0.00	na	na	0.00
4/4/93	82	na	na	0.00	7.10	9.15	2.05	9.15	10.70	1.55	na	9.10	0.00	11.00	13.00	2.00	na	na	0.00	na	na	0.00
4/5/93	83	na	na	0.00	7.10	9.10	2.00	9.15	10.65	1.50	na	9.05	0.00	10.95	12.80	1.85	na	na	0.00	na	na	0.00
4/6/93	84	7.05	8.85	1.80	7.10	9.05	1.95	9.15	10.70	1.55	na	9.10	0.00	10.95	12.85	1.90	na	na	0.00	na	na	0.00
4/7/93	85	7.05	8.85	1.80	7.10	9.05	1.95	9.15	10.70	1.55	na	9.10	0.00	10.95	12.85	1.90	na	na	0.00	na	na	0.00
4/8/93	86	7.05	8.85	1.80	7.10	9.05	1.95	9.15	10.60	1.45	na	9.10	0.00	10.90	12.80	1.90	na	na	0.00	na	na	0.00
4/9/93	87	7.05	8.85	1.80	7.10	9.00	1.90	9.15	10.60	1.45	na	9.05	0.00	10.90	12.80	1.90	na	na	0.00	na	na	0.00
4/12/93	90	7.00	8.80	1.80	7.05	8.95	1.90	9.15	10.50	1.35	na	9.00	0.00	11.00	13.00	2.00	na	na	0.00	na	na	0.00
4/13/93	91	7.00	8.80	1.80	7.05	8.95	1.90	9.15	10.50	1.35	na	9.00	0.00	11.00	13.00	2.00	na	na	0.00	na	na	0.00
4/14/93	92	7.00	8.80	1.80	7.05	8.95	1.90	9.15	10.55	1.40	na	9.00	0.00	11.05	13.05	2.00	na	na	0.00	na	na	0.00
4/15/93	93	7.00	8.80	1.80	7.05	8.95	1.90	9.15	10.55	1.40	na	9.00	0.00	11.05	13.05	2.00	na	na	0.00	na	na	0.00
4/16/93	94	7.00	8.80	1.80	7.05	8.95	1.90	9.15	10.50	1.35	na	9.00	0.00	11.00	12.95	1.95	na	na	0.00	na	na	0.00
4/17/93	95	7.00	8.80	1.80	7.05	8.90	1.85	9.15	10.50	1.35	na	9.00	0.00	11.00	12.90	1.90	na	na	0.00	na	na	0.00
4/18/93	96	7.00	8.80	1.80	7.05	8.90	1.85	9.15	10.50	1.35	na	9.00	0.00	11.00	12.90	1.90	na	na	0.00	na	na	0.00
4/19/93	97	7.00	8.80	1.80	7.05	8.90	1.85	9.15	10.45	1.30	na	9.00	0.00	10.55	12.45	1.90	na	na	0.00	na	na	0.00
4/20/93	98	7.00	8.75	1.75	7.05	8.90	1.85	9.10	10.45	1.35	na	8.95	0.00	10.85	12.75	1.90	na	na	0.00	na	na	0.00
4/21/93	99	6.95	8.75	1.80	7.05	8.90	1.85	9.10	10.40	1.30	na	8.95	0.00	10.85	12.75	1.90	na	na	0.00	na	na	0.00
4/22/93	100	6.95	8.75	1.80	7.05	8.85	1.80	9.10	10.40	1.30	na	8.95	0.00	10.85	12.75	1.90	na	na	0.00	na	na	0.00
4/23/93	101	6.95	8.75	1.80	7.00	8.85	1.85	9.10	10.35	1.25	na	8.90	0.00	10.90	12.85	1.95	na	na	0.00	na	na	0.00

na: no sample available

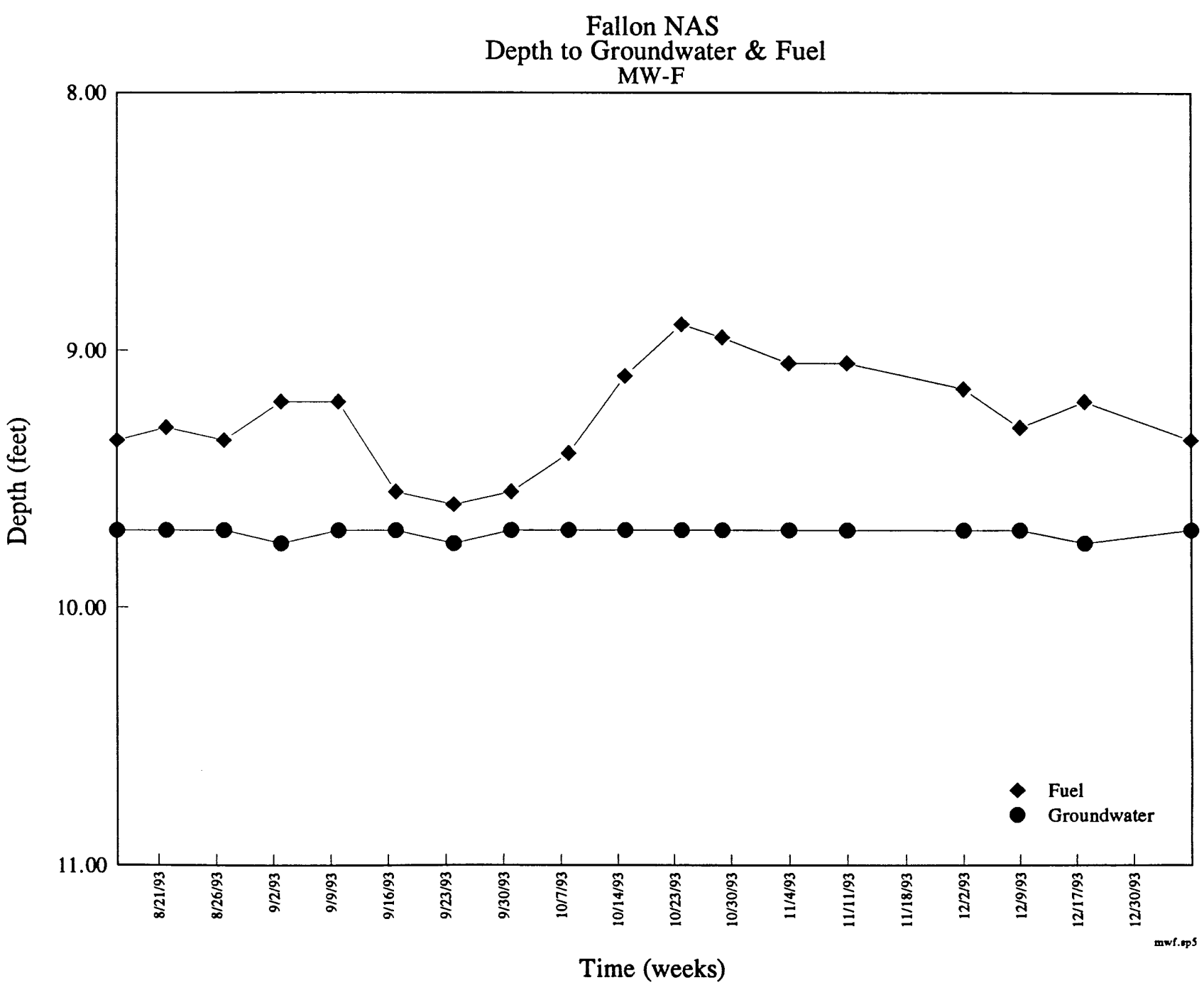
MONITORING WELL MEASUREMENTS (ft)

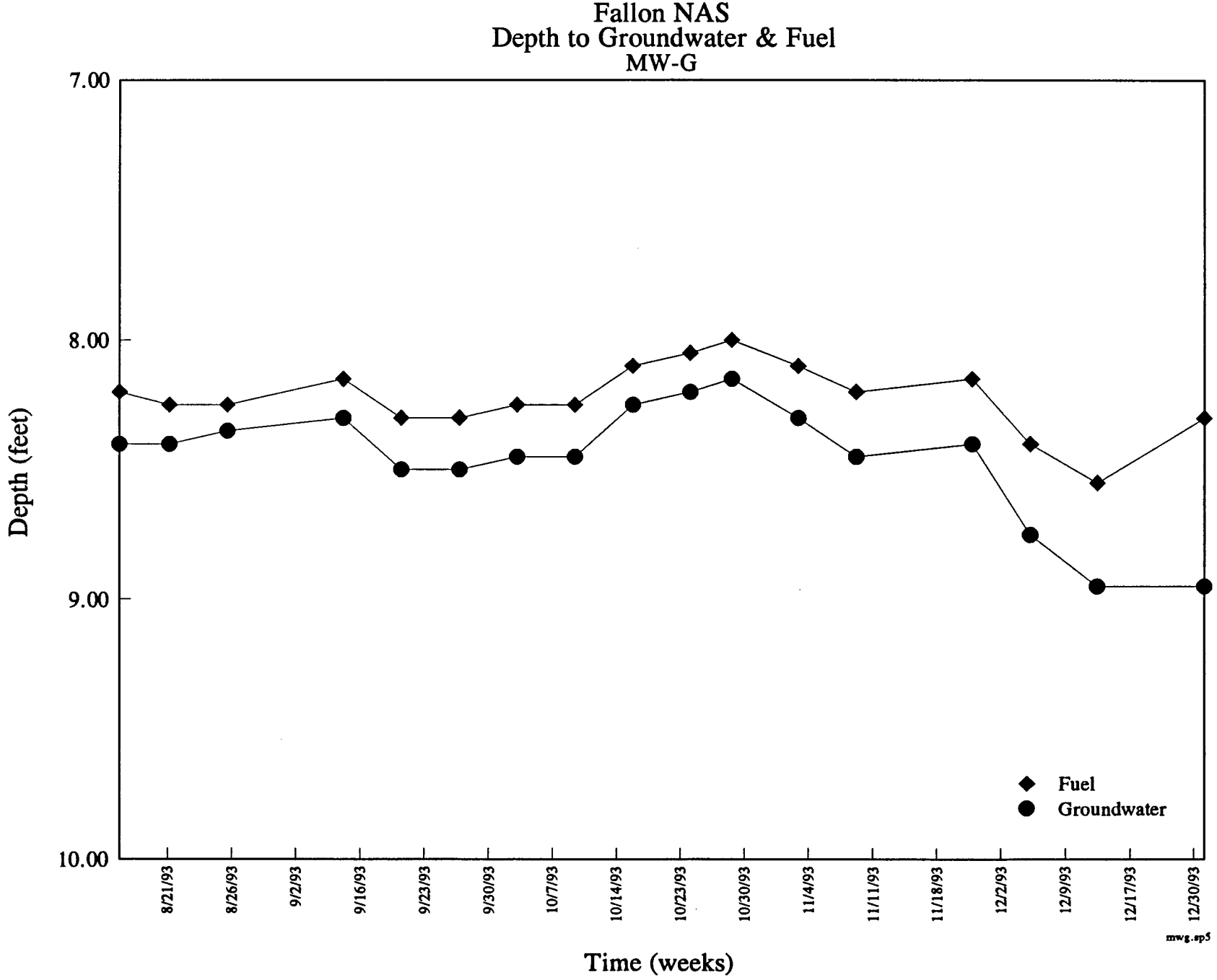
		A			B			C			D			E			F			G		
Date	Cum. Days	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness
4/24/93	102	6.95	8.75	1.80	7.00	8.85	1.85	9.10	10.35	1.25	na	8.90	0.00	10.90	12.85	1.95	na	na	0.00	na	na	0.00
4/25/93	103	6.95	8.75	1.80	7.00	8.85	1.85	9.10	10.35	1.25	na	8.90	0.00	10.90	12.85	1.95	na	na	0.00	na	na	0.00
4/28/93	106	6.75	8.70	1.95	7.00	8.85	1.85	9.05	10.25	1.20	na	8.90	0.00	10.75	12.60	1.85	na	na	0.00	na	na	0.00
4/29/93	107	6.95	8.70	1.75	7.00	8.85	1.85	9.05	10.25	1.20	na	8.90	0.00	10.75	12.60	1.85	na	na	0.00	na	na	0.00
4/30/93	108	6.95	8.70	1.75	7.00	8.80	1.80	9.05	10.30	1.25	na	8.85	0.00	11.00	12.90	1.90	na	na	0.00	na	na	0.00
5/1/93	109	6.95	8.70	1.75	7.00	8.80	1.80	9.10	10.30	1.20	na	8.85	0.00	11.00	12.90	1.90	na	na	0.00	na	na	0.00
5/2/93	110	6.95	8.70	1.75	7.00	8.80	1.80	9.10	10.30	1.20	na	8.85	0.00	11.00	13.00	2.00	na	na	0.00	na	na	0.00
5/5/93	113	6.90	8.65	1.75	7.00	8.75	1.75	9.05	10.20	1.15	na	8.85	0.00	10.85	12.75	1.90	na	na	0.00	na	na	0.00
5/6/93	114	6.90	8.65	1.75	7.00	8.75	1.75	9.05	10.20	1.15	na	8.85	0.00	10.85	12.75	1.90	na	na	0.00	na	na	0.00
5/7/93	115	6.90	8.65	1.75	7.00	8.75	1.75	9.05	10.20	1.15	na	8.85	0.00	10.85	12.75	1.90	na	na	0.00	na	na	0.00
5/8/93	116	6.90	8.65	1.75	7.00	8.70	1.70	9.05	10.20	1.15	na	8.85	0.00	10.85	12.80	1.95	na	na	0.00	na	na	0.00
5/9/93	117	6.90	8.65	1.75	7.00	8.70	1.70	9.05	10.20	1.15	na	8.85	0.00	10.85	12.80	1.95	na	na	0.00	na	na	0.00
5/10/93	118	6.90	8.65	1.75	7.00	8.70	1.70	9.10	10.20	1.10	na	8.85	0.00	10.80	12.75	1.95	na	na	0.00	na	na	0.00
5/11/93	119	6.90	8.65	1.75	7.00	8.70	1.70	9.10	10.20	1.10	na	8.85	0.00	10.80	12.75	1.95	na	na	0.00	na	na	0.00
5/12/93	120	6.90	8.65	1.75	6.95	8.70	1.75	9.05	10.15	1.10	na	8.75	0.00	10.85	12.85	2.00	na	na	0.00	na	na	0.00
5/13/93	121	6.90	8.65	1.75	6.95	8.70	1.75	9.05	10.20	1.15	na	8.75	0.00	10.90	12.90	2.00	na	na	0.00	na	na	0.00
5/14/93	122	7.00	8.80	1.80	7.05	8.95	1.90	9.15	10.55	1.40	na	9.00	0.00	11.05	13.05	2.00	na	na	0.00	na	na	0.00
5/15/93	123	7.00	8.80	1.80	7.05	8.95	1.90	9.15	10.55	1.40	na	9.00	0.00	11.05	13.05	2.00	na	na	0.00	na	na	0.00
5/16/93	124	7.00	8.80	1.80	7.05	8.95	1.90	9.15	10.55	1.40	na	9.00	0.00	11.00	12.95	1.95	na	na	0.00	na	na	0.00
5/17/93	125	7.00	8.80	1.80	7.05	8.90	1.85	9.15	10.55	1.40	na	9.00	0.00	11.00	12.90	1.90	na	na	0.00	na	na	0.00
5/18/93	126	7.00	8.80	1.80	7.05	8.90	1.85	9.15	10.50	1.35	na	9.00	0.00	11.00	12.90	1.90	na	na	0.00	na	na	0.00
5/19/93	127	7.00	8.80	1.80	7.05	8.90	1.85	9.15	10.45	1.30	na	9.00	0.00	10.55	12.45	1.90	na	na	0.00	na	na	0.00
5/23/93	131	6.85	8.55	1.70	6.95	8.60	1.65	9.00	9.90	0.90	na	8.70	8.70	10.20	11.85	1.65	na	na	0.00	na	na	0.00
5/24/93	132	6.85	8.65	1.80	6.95	8.60	1.65	8.95	9.90	0.95	na	8.70	0.00	10.20	11.80	1.60	na	na	0.00	na	na	0.00
5/27/93	135	6.85	8.50	1.65	6.95	8.55	1.60	8.95	9.80	0.85	na	8.65	0.00	10.15	11.65	1.50	na	na	0.00	na	na	0.00
6/4/93	143	6.80	8.50	1.70	6.95	8.55	1.60	8.95	9.75	0.80	na	8.65	0.00	10.80	12.30	1.50	na	na	0.00	na	na	0.00
6/11/93	150	6.70	8.15	1.45	6.95	8.50	1.55	8.95	9.80	0.85	na	8.60	0.00	10.30	11.85	1.55	na	na	0.00	na	na	0.00
6/14/93	153	6.80	8.40	1.60	6.95	8.50	1.55	9.00	9.90	0.90	na	8.65	0.00	10.30	11.85	1.55	na	na	0.00	na	na	0.00
6/16/93	155	6.85	8.40	1.55	6.95	8.50	1.55	9.05	10.00	0.95	na	8.70	0.00	10.30	11.90	1.60	na	na	0.00	na	na	0.00
6/26/93	165	6.85	8.40	1.55	6.95	8.50	1.55	9.10	10.05	0.95	na	8.65	0.00	10.35	12.10	1.75	na	na	0.00	na	na	0.00
7/1/93	170	6.90	8.40	1.50	6.95	8.55	1.60	9.15	10.10	0.95	na	8.65	0.00	10.50	12.45	1.95	na	na	0.00	na	na	0.00
7/8/93	177	6.90	8.40	1.50	6.95	8.55	1.60	9.15	10.00	0.85	na	8.60	0.00	10.40	12.25	1.85	na	na	0.00	na	na	0.00

MONITORING WELL MEASUREMENTS (ft)

		A			B			C			D			E			F			G		
Date	Cum. Days	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness	Fuel Depth	Water Depth	Fuel Layer Thick-ness
7/23/93	191	6.85	8.40	1.55	6.95	8.55	1.60	9.05	9.70	0.65	na	8.60	0.00	10.25	12.00	1.75	na	na	0.00	na	na	0.00
8/21/93	219	6.80	8.30	1.50	6.95	8.45	1.50	8.95	9.50	0.55	na	8.45	0.00	10.50	12.60	2.10	9.35	9.70	0.35	8.20	8.40	0.20
8/26/93	225	6.80	8.25	1.45	6.90	8.40	1.50	8.95	9.45	0.50	na	8.40	0.00	10.50	12.75	2.25	9.30	9.70	0.40	8.25	8.40	0.15
9/2/93	232	6.80	8.30	1.50	6.90	8.40	1.50	9.00	9.45	0.45	na	8.40	0.00	10.55	12.70	2.15	9.35	9.70	0.35	8.25	8.35	0.10
9/9/93	239	6.80	8.30	1.50	6.90	8.40	1.50	8.95	9.40	0.45	na	8.30	0.00	10.25	12.30	2.05	9.20	9.75	0.55	na	8.15	8.15
9/16/93	246	6.80	8.30	1.50	6.90	8.35	1.45	8.90	9.40	0.50	na	8.30	0.00	10.20	12.40	2.20	9.20	9.70	0.50	8.15	8.30	0.15
9/23/93	253	6.85	8.35	1.50	6.90	8.35	1.45	9.05	9.60	0.55	na	8.30	0.00	10.70	12.80	2.10	9.55	9.70	0.15	8.30	8.50	0.20
9/30/93	260	6.85	8.45	1.60	6.95	8.40	1.45	9.15	9.60	0.45	na	8.30	0.00	10.70	12.55	1.85	9.60	9.75	0.15	8.30	8.50	0.20
10/7/93	267	6.85	8.45	1.60	6.95	8.35	1.40	9.15	9.45	0.30	na	8.25	0.00	10.55	12.30	1.75	9.55	9.70	0.15	8.25	8.45	0.20
10/14/93	274	6.85	8.40	1.55	6.90	8.35	1.45	9.05	9.25	0.20	na	8.30	0.00	10.40	12.10	1.70	9.40	9.70	0.30	8.25	8.45	0.20
10/23/93	281	6.75	8.20	1.45	6.90	8.20	1.30	8.80	9.05	0.25	na	8.25	0.00	10.10	11.40	1.30	9.10	9.70	0.60	8.10	8.25	0.15
10/30/93	288	6.70	8.15	1.45	6.85	8.05	1.20	8.75	9.00	0.25	na	8.25	0.00	9.95	11.20	1.25	8.90	9.70	0.80	8.05	8.20	0.15
11/4/93	293	6.75	7.85	1.10	6.85	8.05	1.20	8.70	9.00	0.30	na	8.20	0.00	10.15	10.35	0.20	8.95	9.70	0.75	8.00	8.15	0.15
11/5/93	294	6.75	7.90	1.15	6.85	8.05	1.20	8.70	8.90	0.20	na		0.00	10.20	10.50	0.30	na	na	0.00	na	na	0.00
11/6/93	296	6.75	7.85	1.10	6.85	8.05	1.20	8.70	9.00	0.30	na		0.00	10.25	10.60	0.35	na	na	0.00	na	na	0.00
11/8/93	298	6.75	7.85	1.10	6.85	8.05	1.20	8.70	9.00	0.30	na		0.00	10.30	10.65	0.35	na	na	0.00	na	na	0.00
11/10/93	300	6.75	8.85	2.10	6.85	8.05	1.20	8.75	9.10	0.35	na		0.00	10.35	10.70	0.35	na	na	0.00	na	na	0.00
11/11/93	301	6.75	7.85	1.10	6.80	8.00	1.20	8.75	9.10	0.35	na	8.20	0.00	10.35	10.70	0.35	9.05	9.70	0.65	8.10	8.30	0.20
11/13/93	303	6.70	7.85	1.15	6.80	8.00	1.20	8.75	9.15	0.40	na		0.00	10.25	10.45	0.20	na	na	0.00	na	na	0.00
11/18/93	308	6.85	8.05	1.20	6.85	8.10	1.25	8.85	9.25	0.40	na	8.30	0.00	10.35	10.65	0.30	9.05	9.70	0.65	8.20	8.45	0.25
12/2/93	322	6.90	8.15	1.25	6.95	8.20	1.25	8.85	9.25	0.40	na	8.35	0.00	10.45	10.80	0.35	9.15	9.70	0.55	8.15	8.40	0.25
12/9/93	329	6.85	8.00	1.15	6.95	8.10	1.15	8.80	9.15	0.35	na	8.45	0.00	10.55	10.95	0.40	9.30	9.70	0.40	8.40	8.75	0.35
12/17/93	337	6.85	8.00	1.15	6.95	8.10	1.15	8.85	9.15	0.30	na	8.45	0.00	10.50	10.80	0.30	9.20	9.75	0.55	8.55	8.95	0.40
12/30/93	350	6.90	8.00	1.10	6.95	8.10	1.15	8.85	9.20	0.35	na	8.45	0.00	10.75	11.25	0.50	9.35	9.70	0.35	8.30	8.95	0.65

na: no sample available


Fallon NAS
Depth to Groundwater & Fuel
MW-F
8.00
9.00
10.00
11.00
Depth (feet)
Fuel
Groundwater
8/21/93
8/26/93
9/2/93
9/9/93
9/16/93
9/23/93
9/30/93
10/7/93
10/14/93
10/23/93
10/30/93
11/4/93
11/11/93
11/18/93
12/2/93
12/9/93
12/17/93
12/30/93
mwf.sp5
Time (weeks)


Fallon NAS
Depth to Groundwater & Fuel
MW-G
7.00
8.00
9.00
10.00
Depth (feet)
Fuel
Groundwater
8/21/93
8/26/93
9/2/93
9/16/93
9/23/93
9/30/93
10/7/93
10/14/93
10/23/93
10/30/93
11/4/93
11/11/93
11/18/93
12/2/93
12/9/93
12/17/93
12/30/93
mwg.sp5
Time (weeks)

APPENDIX E

QUARTERLY GROUNDWATER LEVEL AND FREE PRODUCT THICKNESS DATA FOR BIOSLURPER EXTRACTION WELLS

Depth to Groundwater and Fuel for Bioslurper Extraction Wells

DATA FOR:	WELL #1		WELL #2		WELL #3		WELL #4		WELL #5		WELL #6	
Well 1 to 6	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)
NOV. 13, 1992	8.9	9.24	9.5	9.88	9.35	11.14	9.7	11.55	–	10	9.75	11.85
MAR. 22, 1993	8.7	10.15	9.4	10.75	9.5	10.95	10.1	10.15	9.8	10.4	9.85	11.8
JUL 21, 1993	8.5	9.6	9.2	10	9.4	10.9	10.1	10.3	9.7	10.8	9.9	11.8
OCT 29, 1993	–	8.4	9.05	9.1	9.25	9.3	9.6	9.75	9.35	9.55	9.7	9.95

DATA FOR:	WELL #7		WELL #8		WELL #9		WELL #10		WELL #11		WELL #12	
Well 7 to 12	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)
NOV. 13, 1992	9.6	11.7	–	9.9	9.85	11.95	9.9	11.95	9.6	11.8	9.4	11.7
MAR. 22, 1993	9.7	11.6	–	9.95	9.9	12	10	12.15	9.75	11.7	9.7	11
JUL 21, 1993	9.9	11.8	10.1	10.4	10	12.6	10.2	12.3	9.8	11.8	9.7	11.6
OCT 29, 1993	9.4	10.3	9.4	9.6	9.7	10.7	9.8	10.75	9.5	10.3	9.35	10.7

DATA FOR:	WELL #13		WELL #14		WELL #15		WELL #16		WELL #17		WELL #18	
Well 13 to 18	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)
NOV. 13, 1992	9.8	9.9	9.15	11.7	9.15	10.9	8.5	10.65	8.55	10.45	9.05	11.3
MAR. 22, 1993	10	10.05	9.9	10.8	9.5	9.7	8.7	10.3	8.6	10.2	9.45	10.1
JUL 21, 1993	–	10	9.7	11.5	–	9.4	8.5	9.6	8.4	9.7	9.3	9.8
OCT 29, 1993	9.55	9.6	9.6	9.7	9	9.15	–	8.45	8.4	8.45	9.05	9.15

DATA FOR:	WELL #19		WELL #20		WELL #21		WELL #22		WELL #23		WELL #24	
Well 19 to 24	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)
NOV. 13, 1992	9.7	11.9	9.55	11.8	9.7	12	9.55	10.65	–	11.8	9.73	12
MAR. 22, 1993	10.05	11.15	10.1	10.2	9.9	11.85	10.25	12.45	–	10.9	9.85	12.05
JUL 21, 1993	9.8	11.5	–	10.1	9.9	12	10.3	12.8	10.9	11.7	9.9	12.4
OCT 29, 1993	9.7	10.3	9.65	9.8	9.6	10.8	10.95	11.3	10.3	11.3	9.65	10.75

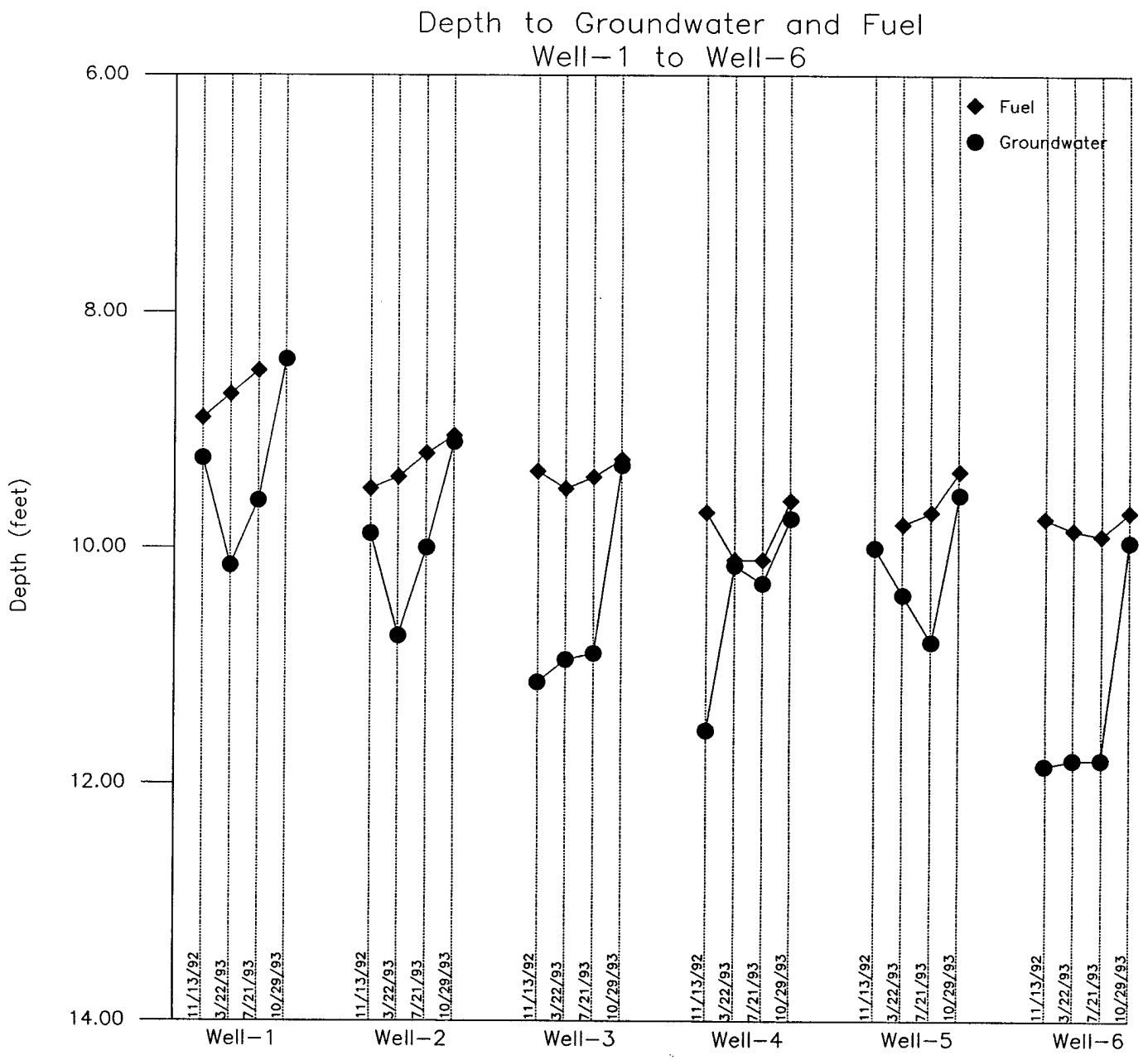
Depth to Groundwater and Fuel for Bioslurper Extraction Wells

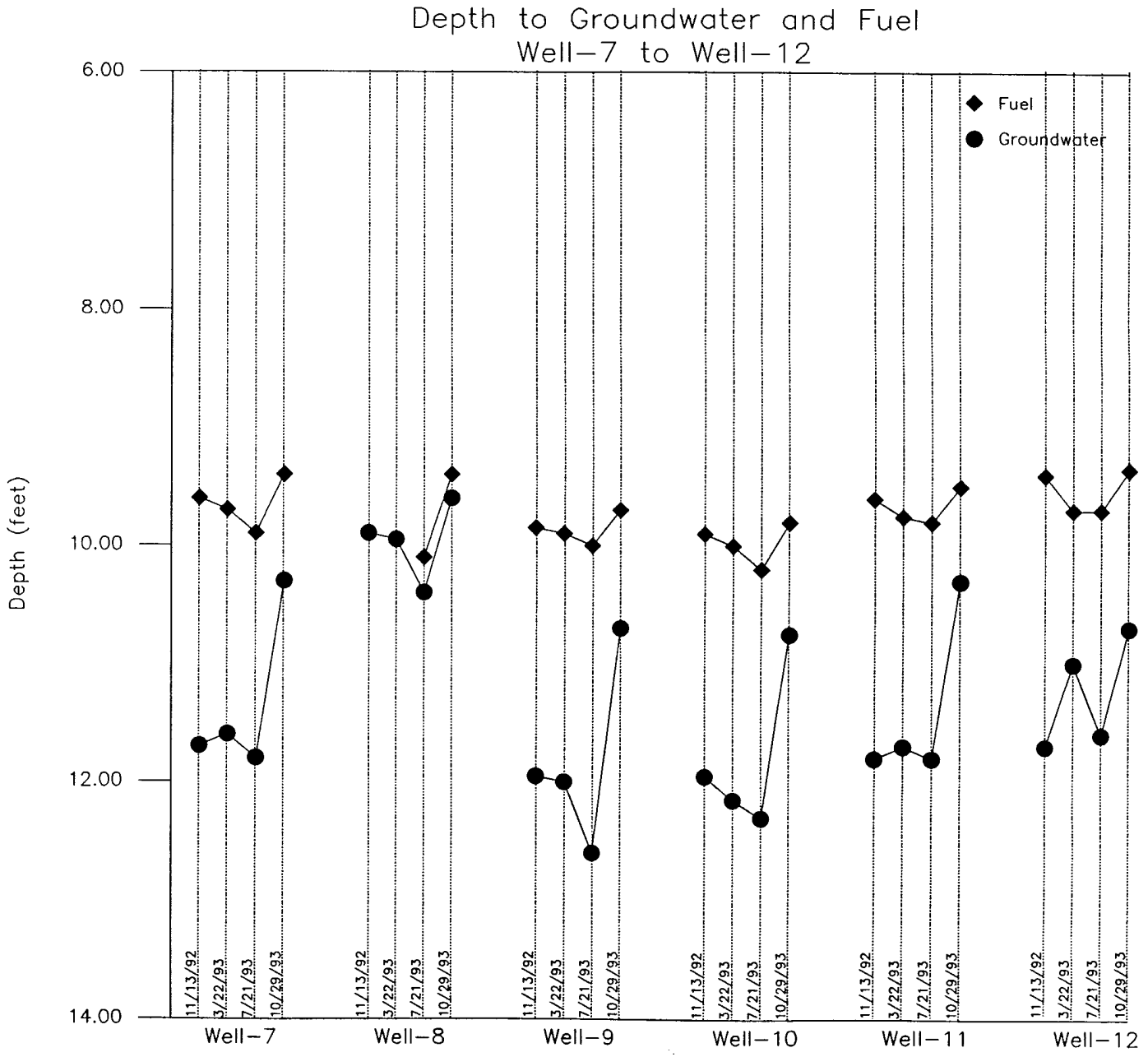
DATA FOR:	WELL #25		WELL #26		WELL #27		WELL #28		WELL #29		WELL #30	
Well 25 to 29	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)
NOV. 13, 1992	10.05	12.45	10.3	12.7	–	10.95	–	10.75	10	12.35	9.7	12.1
MAR. 22, 1993	10.15	12.5	10.4	12.9	10.55	13.3	10.4	12.8	10.5	10.75	10.05	11.3
JUL 21, 1993	10.2	12.8	10.4	13.2	10.6	13.4	10.4	13.2	10.3	11.6	9.8	11.8
OCT 29, 1993	9.9	11.35	10.15	11.8	10.35	11.9	10.3	11.1	9.9	11	9.6	10.65

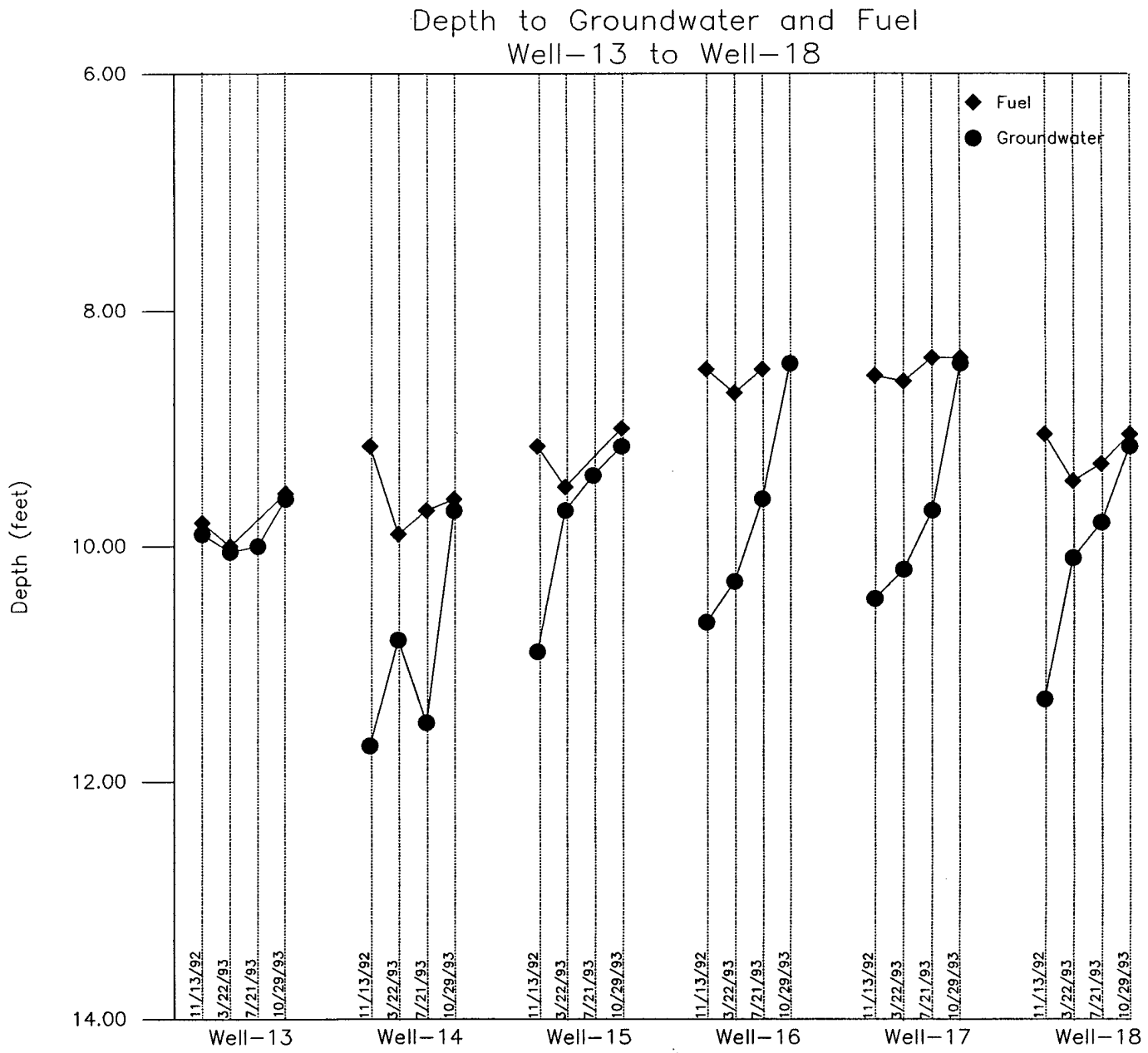
DATA FOR:	WELL #31		WELL #32		WELL #33		WELL #34		WELL #35		WELL #36	
Well 31 to 36	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)
NOV. 13, 1992	9.05	1.4	8.8	11.2	8.55	11.1	–	9.65	10.05	12.4	–	12.35
MAR. 22, 1993	9.3	11.95	9	10.65	8.65	10.7	10.35	11.5	10.25	12.3	12.05	14.1
JUL 21, 1993	9	11.1	8.7	10.4	8.5	10.4	9.1	11.3	10	12.5	11.8	14.5
OCT 29, 1993	9.05	9.55	8.7	9.35	8.4	9.35	9.15	9.85	9.85	11.35	11.7	13.25

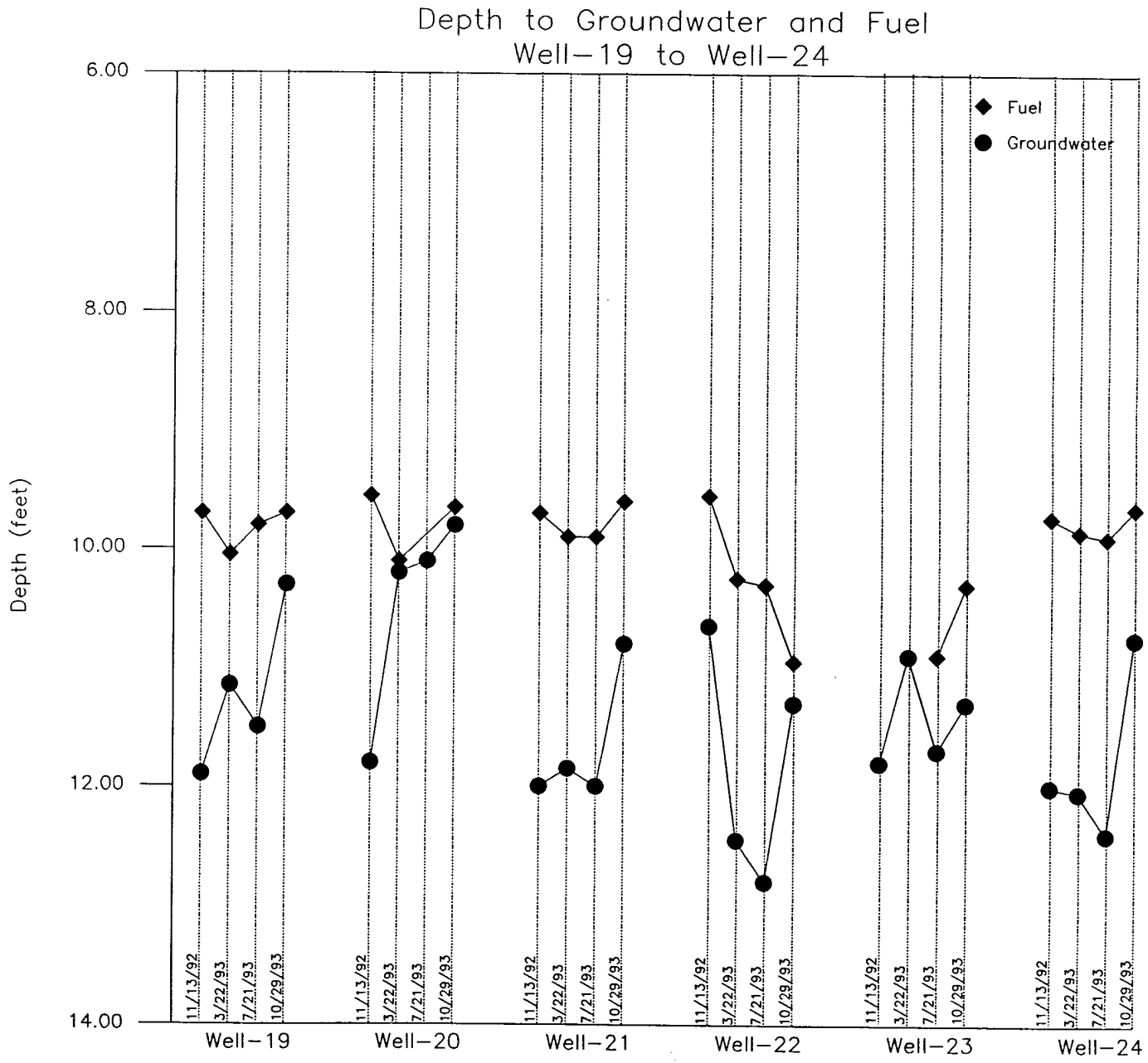
DATA FOR:	WELL #37		WELL #38		WELL #39		WELL #40		WELL #41		WELL #42	
Well 37 to 42	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)
NOV. 13, 1992	–	13.2	11.9	13.9	–	12	10.1	12.5	10.05	12.25	11.45	11.95
MAR. 22, 1993	12.9	15.4	–	12.4	–	12.05	10.25	12.8	10.1	12.8	11.35	13
JUL 21, 1993	12.8	15.7	12.4	12.5	12	12.2	10.2	12.9	10	12.8	11	14.2
OCT 29, 1993	12.6	14.3	11.95	12.1	11.6	11.65	9.95	11.75	9.8	11.6	10.85	12.9

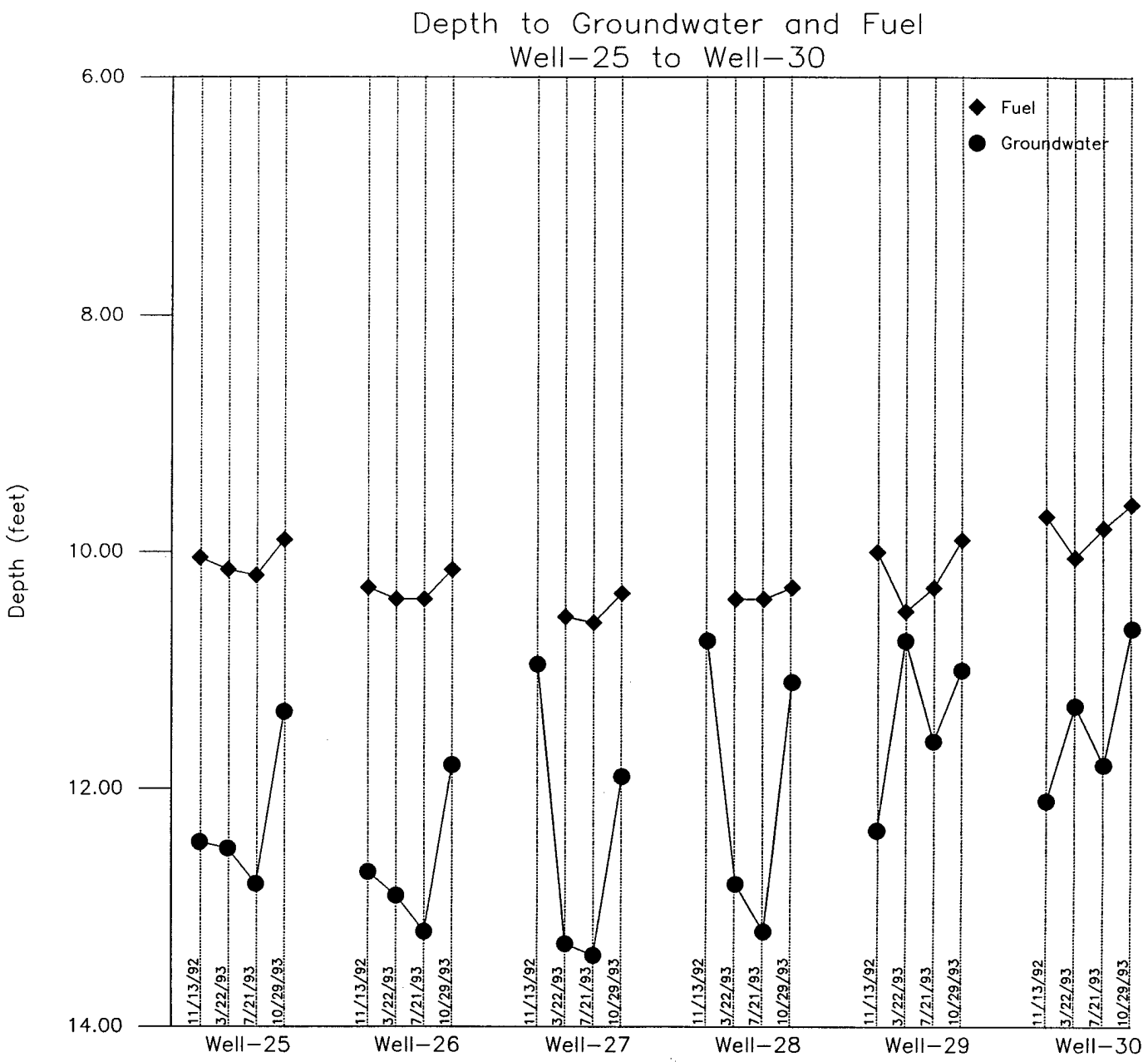
DATA FOR:	WELL #43		WELL #44		WELL #45		WELL #46		WELL #47		WELL #48	
Well 43 to 48	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)	FUEL (ft)	GW (ft)
NOV. 13, 1992	–	11.15	–	11.7	–	11.5	10.6	13.05	9.65	12.25	8.9	11.55
MAR. 22, 1993	10.8	13.35	11.55	14.15	11.2	13.7	10.75	13.2	9.8	12.15	9	11.1
JUL 21, 1993	10.6	13.7	11.4	14.6	11	14	10.5	13.3	9.6	11.9	8.7	10.7
OCT 29, 1993	10.8	11.25	11.25	13.25	10.9	12.65	10.45	12.1	9.5	10.9	8.75	9.6

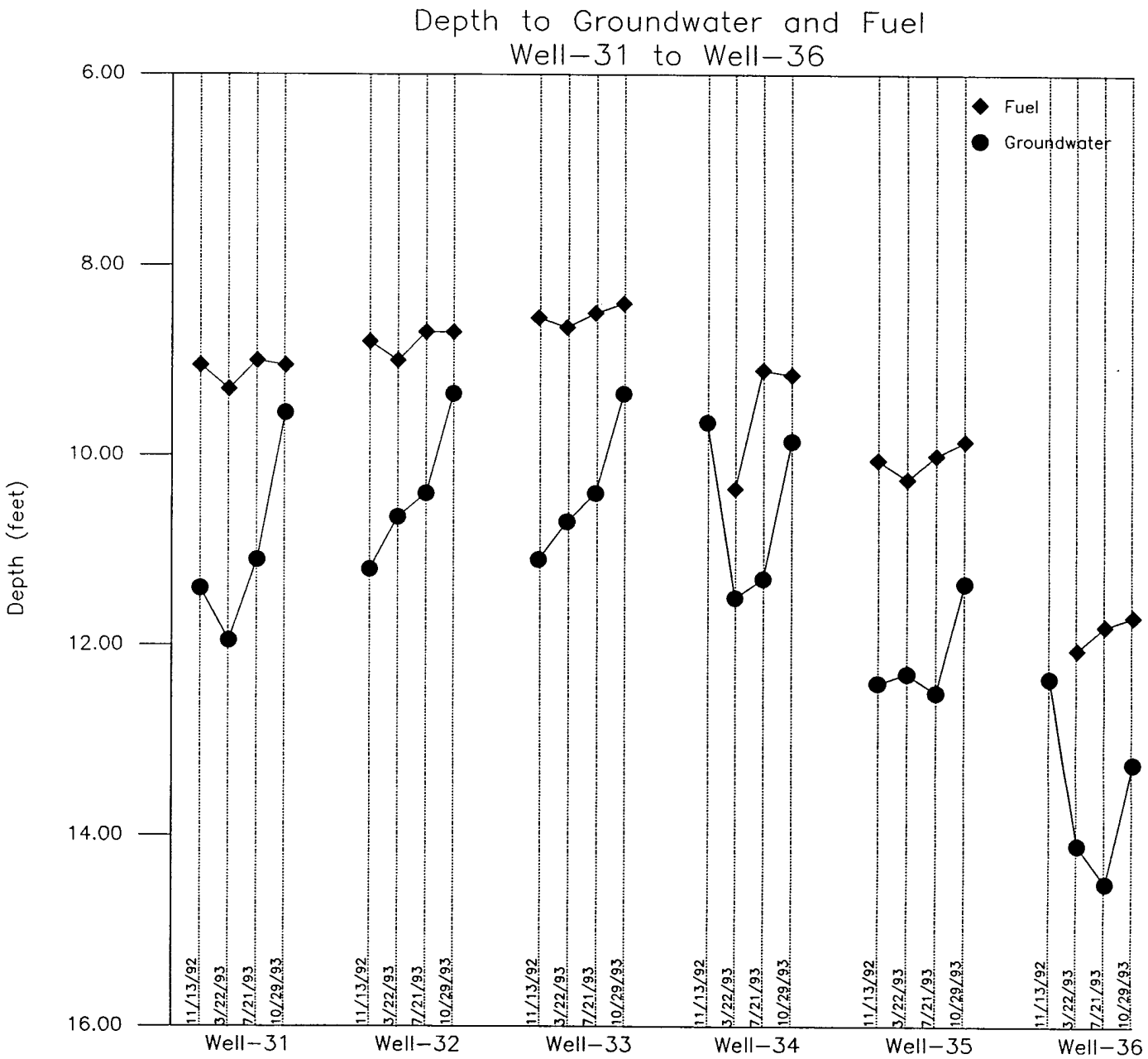

Depth to Groundwater and Fuel
Well-1 to Well-6
Fuel
Groundwater
Depth (feet)
6.00
8.00
10.00
12.00
14.00
11/13/92
3/22/93
7/21/93
10/29/93
Well-1
Well-2
Well-3
Well-4
Well-5
Well-6

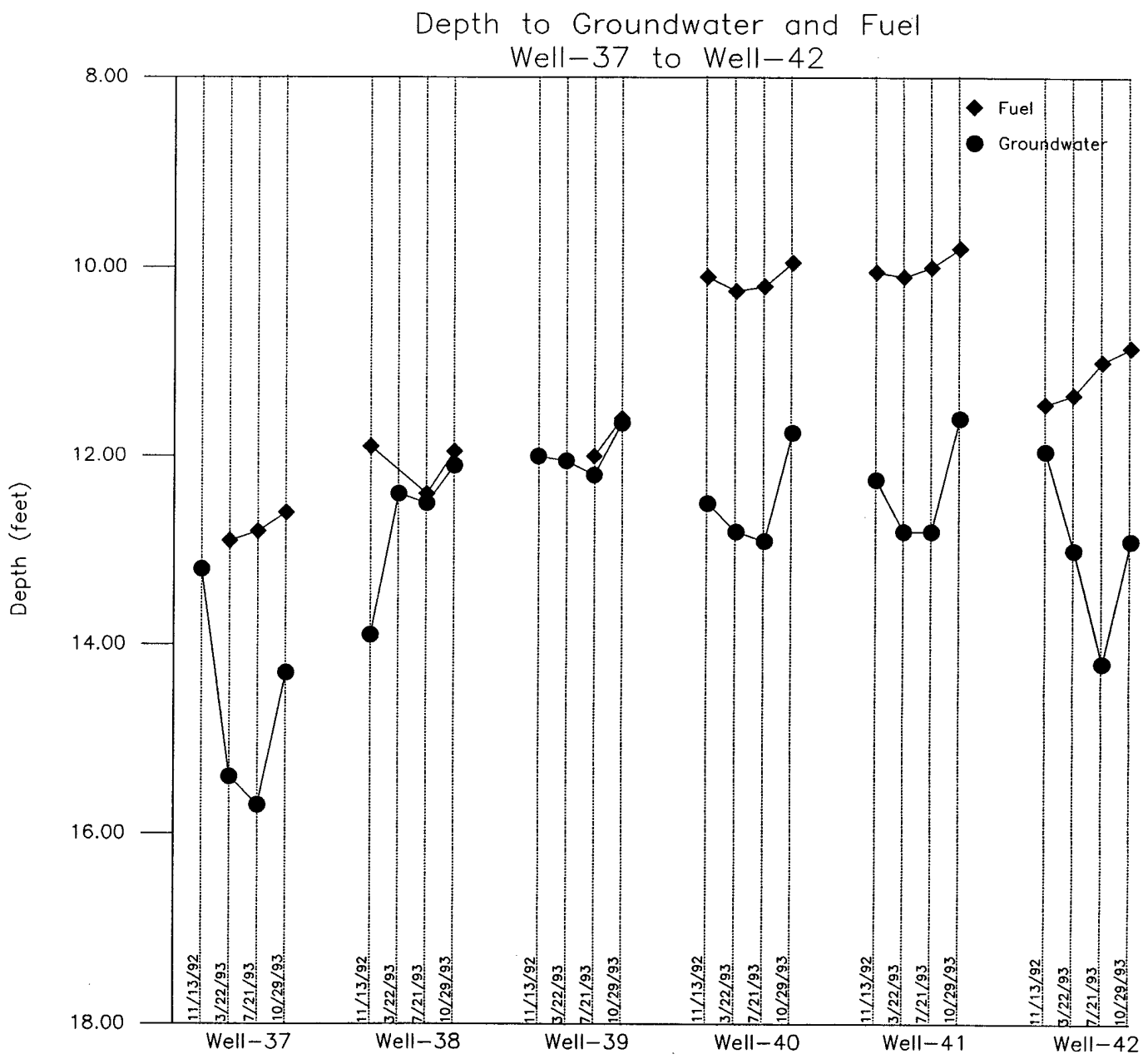

Depth to Groundwater and Fuel
Well-7 to Well-12
Depth (feet)
6.00
8.00
10.00
12.00
14.00
Fuel
Groundwater
11/13/92
3/22/93
7/21/93
10/29/93
Well-7
Well-8
Well-9
Well-10
Well-11
Well-12

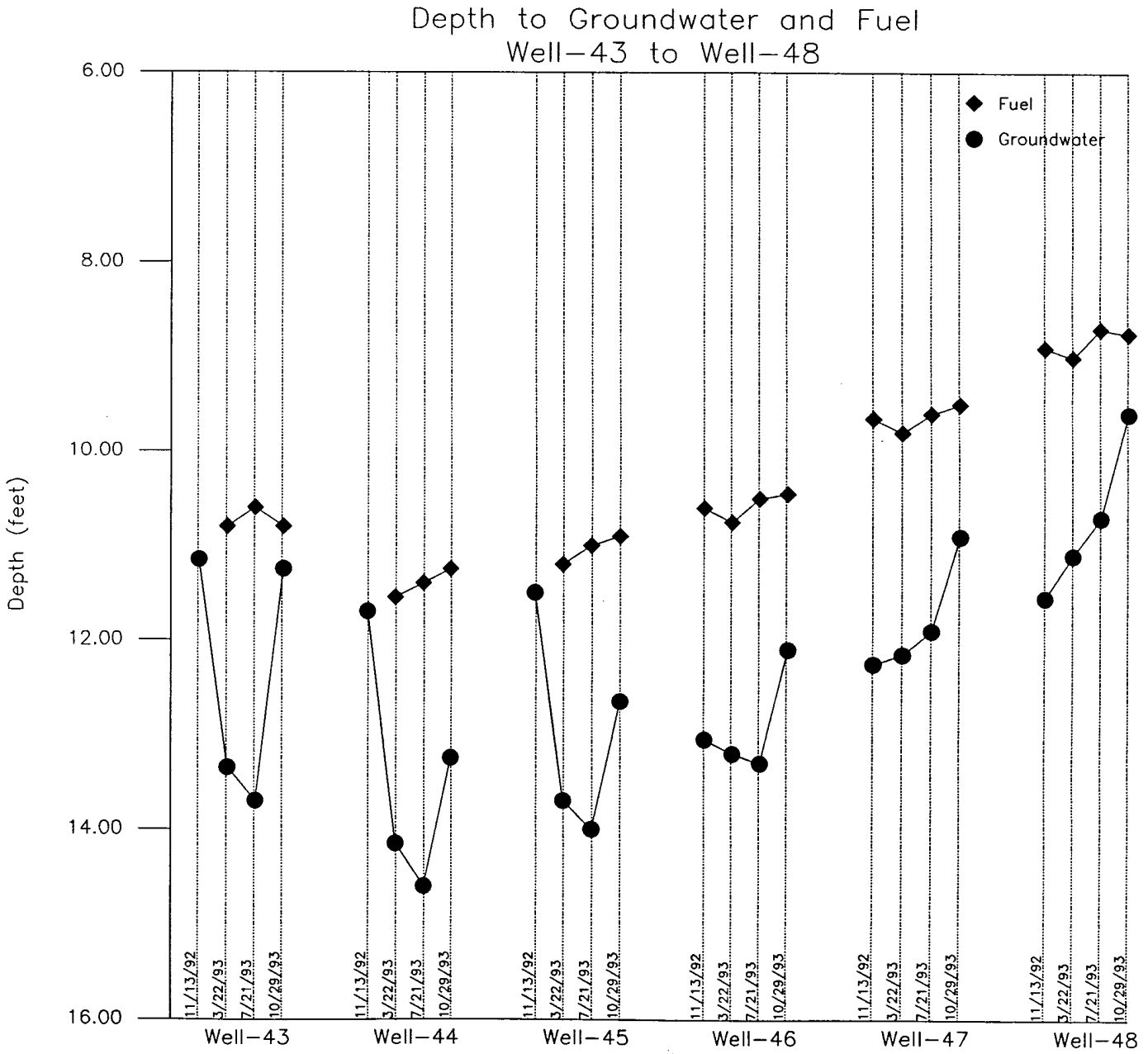

Depth to Groundwater and Fuel
Well-13 to Well-18
Depth (feet)
6.00
8.00
10.00
12.00
14.00
Fuel
Groundwater
11/13/92
3/22/93
7/21/93
10/29/93
Well-13
Well-14
Well-15
Well-16
Well-17
Well-18


Depth to Groundwater and Fuel
Well-19 to Well-24
Depth (feet)
6.00
8.00
10.00
12.00
14.00
Fuel
Groundwater
11/13/92
3/22/93
7/21/93
10/29/93
Well-19
Well-20
Well-21
Well-22
Well-23
Well-24


Depth to Groundwater and Fuel
Well-25 to Well-30
Depth (feet)
6.00
8.00
10.00
12.00
14.00
Fuel
Groundwater
11/13/92
3/22/93
7/21/93
10/29/93
Well-25
Well-26
Well-27
Well-28
Well-29
Well-30


Depth to Groundwater and Fuel
Well-31 to Well-36
Fuel
Groundwater
Depth (feet)
6.00
8.00
10.00
12.00
14.00
16.00
11/13/92
3/22/93
7/21/93
10/29/93
Well-31
Well-32
Well-33
Well-34
Well-35
Well-36


Depth to Groundwater and Fuel
Well-37 to Well-42
8.00
10.00
12.00
14.00
16.00
18.00
Depth (feet)
Fuel
Groundwater
11/13/92
3/22/93
7/21/93
10/29/93
Well-37
Well-38
Well-39
Well-40
Well-41
Well-42


Depth to Groundwater and Fuel
Well-43 to Well-48
Fuel
Groundwater
Depth (feet)
6.00
8.00
10.00
12.00
14.00
16.00
11/13/92
3/22/93
7/21/93
10/29/93
Well-43
Well-44
Well-45
Well-46
Well-47
Well-48

APPENDIX F

SOIL GAS DATA

		LEVEL A (G)				LEVEL B (B)				LEVEL C (Y)			
MPT	Date	% O2	% CO2	HC (ppm)	Pressure (in water)	% O2	% CO2	HC (ppm)	Pressure (in water)	% O2	% CO2	HC (ppm)	Pressure (in water)
1	11/12/92	20.5	0.6	120		20.0	1.0	170		20.0	1.0	190	
	11/13/92	20.9	0.5	60		20.5	0.6	100		20.5	0.8	130	
	11/14/92	20.9	0.6	100		20.5	0.7	140		19.5	0.8	200	
	11/20/92	20.9	0.6	90		20.5	0.8	160		19.5	1.0	250	
	12/02/92	20.9	0.1	80		20.5	2.0	400		18.5	4.1	400	
	1/12/93	20.9	0.2			20.5	0.7						
	1/15/93	20.9	0.1			20.5	0.8			19.0	1.8		
	1/18/93	20.9	0.5		0.00	20.1	0.8		−0.01	19.0	2.0		−0.03
	1/20/93	20.8	0.2		0.00	20.5	0.6		0.02	19.0	1.8		0.01
	1/28/93	21.1	0.6		0.00	20.9	1.0		−0.02	19.6	1.6		−0.02
	2/4/93	20.9	0.5		−0.01	20.6	0.5		−0.03	19.1	1.9		−0.02
	2/12/93	20.6	0.8		0.00	20.1	1.1		−0.02	19.0	2.4		−0.02
	2/19/93	20.9	0.8		0.00	20.6	1.1		−0.01	19.5	2.2		−0.01
	2/26/93	20.8	0.6		−0.01	20.5	0.8		−0.02	19.2	2.0		−0.02
	3/4/93	20.8	0.6		0.00	20.6	0.8		−0.02	19.2	2.0		−0.02
	3/11/93	20.3	0.8		0.00	20.0	0.9		−0.01	19.0	2.1		−0.01
	3/25/93	20.8	0.6	10	0.00	20.2	0.8	30	0.00	19.2	2.0	180	0.00
	4/3/93	20.8	0.6	10	0.00	20.2	0.8	30	−0.01	19.7	1.8	220	−0.01
	4/8/93	20.7	0.6	0	0.00	20.2	0.8	20	0.00	19.2	1.8	180	0.00
	4/15/93	20.8	0.6	10	0.00	20.5	0.8	20	0.00	19.8	1.8	160	0.00
	4/22/93	20.8	0.7	10	0.00	20.4	0.8	20	0.00	19.7	1.9	140	0.00
	4/29/93	20.8	0.7	0	0.00	20.4	0.8	20	0.00	19.2	2.9	180	0.00
	5/6/93	20.7	0.6	20	0.00	20.3	0.8	20	0.00	19.0	2.8	240	0.00
	5/13/93	20.8	0.7	20	0.00	20.6	0.9	20	0.00	19.2	2.1	200	0.00
	5/20/93	20.8	0.7	20	0.00	20.6	0.9	40	0.00	19.4	2.2	200	0.00
	9/21/93	20.9	0.5	0	0.00	20.7	1.2	40	−0.06	20.0	2.9	420	−0.08
	10/30/93	20.5	0.5	10		20.1	0.8	40		18.9	2.0	360	
2	11/12/92	20.5	0.6	130		20.5	0.8	160		20.0	1.0	220	
	11/13/92	20.9	0.5	80		20.9	0.5	110		20.5	0.7	200	
	11/14/92	20.9	0.5	110		20.9	0.5	150		20.0	0.7	290	
	11/20/92	20.9	0.6	70		20.5	0.7	120		19.5	1.0	380	
	12/02/92	20.9	0.1	20		20.9	0.5	100		19.2	2.5	400	
	1/12/93	20.9	0.2			20.0	0.8			19.5	1.1		
	1/15/93	20.8	0.2			20.5	1.0			19.5	1.8		
	1/18/93	20.5	0.5		0.00	19.9	1.0		0.00	19.0	1.3		−0.04
	1/20/93	20.6	0.1		0.01	19.5	0.8		0.00	19.0	1.0		0.00
	1/28/93	20.7	0.6		0.00	19.9	1.3		0.00	20.2	1.4		0.00
	2/4/93	20.7	0.5		0.00	20.0	1.0		0.00	19.2	1.2		0.00
	2/12/93	20.3	0.8		0.00	19.8	1.2		0.00	19.2	1.8		0.00
	2/19/93	20.9	0.8		0.00	20.0	1.8		0.00	19.6	2.0		0.00
	2/26/93	20.7	0.6		0.00	20.0	1.0		0.00	19.4	1.0		0.00
	3/4/93	20.8	0.6		0.00	20.0	1.1		0.00	19.5	1.4		0.00
	3/11/93	20.8	0.7		0.00	20.0	0.9		0.00	19.8	1.5		0.00
	3/25/93	20.7	0.7	10	0.00	19.9	1.0	60	0.00	19.2	1.4	200	0.00
	4/3/93	20.4	0.7	10	0.00	19.9	1.0	80	0.00	19.5	1.2	240	0.00
	4/8/93	20.6	0.6	10	0.00	19.8	1.2	60	0.00	19.2	1.2	200	0.00
	4/15/93	20.7	0.7	20	0.00	19.9	1.0	80	0.00	19.2	1.2	200	0.00
	4/22/93	20.7	0.7	10	0.00	19.8	1.1	60	0.00	19.6	1.3	220	0.00
	4/29/93	20.8	0.7	0	0.00	20.0	1.0	60	0.00	19.8	1.2	220	0.00
	5/6/93	20.8	0.6	10	0.00	20.0	1.0	60	0.00	19.4	1.1	260	0.00
	5/13/93	20.8	0.7	10	0.00	20.0	1.2	70	0.00	19.8	1.4	220	0.00
	5/20/93	20.9	0.7	20	0.00	20.2	1.3	70	0.00	19.8	1.6	240	0.00
	9/21/93	20.9	0.6	60	0.00	19.5	1.9	120	0.00	18.7	1.9	640	0.00
	10/30/93	20.8	0.5	0		19.9	1.0	60		19.2	2.2	720	

		LEVEL A (G)				LEVEL B (B)				LEVEL C (Y)			
MPT	Date	% O2	% CO2	HC (ppm)	Pressure (in water)	% O2	% CO2	HC (ppm)	Pressure (in water)	% O2	% CO2	HC (ppm)	Pressure (in water)
3	11/12/92	20.5	0.7	140		20.0	1.0	180		19.5	1.0	200	
	11/13/92	20.9	0.5	60		20.5	0.8	120		20.0	0.8	160	
	11/14/92	20.9	0.5	110		20.5	0.8	150		20.0	0.8	220	
	11/20/92	20.9	0.5	80		20.0	0.7	150		19.5	0.9	220	
	12/02/92	20.9	0.1	10		20.7	1.5	100		19.8	2.0	280	
	1/12/93	20.9	0.1			20.5	0.7			19.8	1.0		
	1/15/93	20.9	0.2			20.5	0.8			19.5	1.0		
	1/18/93	20.9	0.5		0.00	20.5	0.7		0.00	19.2	1.0		-0.01
	1/20/93	20.9	0.1		0.00	20.5	0.7		0.01	19.5	0.9		0.00
	1/28/93	20.9	1.0		0.00	20.9	0.9		0.00	20.3	1.2		0.00
	2/4/93	20.9	0.4		0.00	20.6	0.8		0.00	19.2	1.2		0.00
	2/12/93	20.6	0.8		0.00	20.2	1.2		0.00	19.2	1.6		0.00
	2/19/93	20.9	0.8		0.00	20.6	1.2		0.01	19.8	1.4		0.01
	2/26/93	20.8	0.6		0.00	20.3	0.7		0.00	19.8	0.9		0.00
	3/4/93	20.8	0.6		0.00	20.4	0.8		0.00	19.8	1.0		0.00
	3/11/93	20.9	0.6		0.00	20.7	0.8		0.00	19.6	1.0		0.00
	3/25/93	20.8	0.6	0	0.00	20.2	0.8	20	0.00	19.2	1.2	160	0.00
	4/3/93	20.9	0.6	0	0.00	20.2	0.7	20	0.00	19.8	0.9	140	0.00
	4/8/93	20.7	0.6	10	0.00	20.0	0.8	20	0.00	19.0	1.0	140	0.00
	4/15/93	20.8	0.6	10	0.00	20.2	0.8	30	0.00	19.8	0.9	160	0.00
	4/22/93	20.8	0.6	0	0.00	20.3	0.8	20	0.00	19.8	0.9	140	0.00
	4/29/93	20.8	0.6	10	0.00	20.4	0.8	20	0.00	19.9	0.9	160	0.00
	5/6/93	20.8	0.6	0	0.00	20.2	0.9	10	0.00	19.3	1.0	200	0.00
	5/13/93	20.9	0.6	10	0.00	20.4	0.8	20	0.00	19.8	0.9	150	0.00
	5/20/93	20.9	0.6	0	0.00	20.2	0.8	20	0.00	19.8	0.9	140	0.00
	9/21/93	20.9	0.6	20	0.00	20.1	1.1	40	0.00	19.2	1.0	440	0.00
	10/30/93	20.9	0.5	0		20.7	0.8	20		19.6	0.9	340	
4	11/12/92	20.0	0.8	200		19.0	1.0	220		18.5	1.5	260	
	11/13/92	20.5	0.9	120		20.0	1.0	160		19.0	1.0	200	
	11/14/92	20.0	0.7	150		19.5	1.0	180		18.5	1.7	240	
	11/20/92	20.0	0.9	120		19.0	1.8	210		17.0	2.5	430	
	12/02/92	20.9	0.1	25		19.0	4.2	200		17.0	5.8	400	
	1/12/93	20.9	0.1			19.8	1.5			18.5	2.5		
	1/15/93	20.9	0.2			20.0	1.5			18.0	2.8		
	1/18/93	20.9	0.1		0.00	20.0	1.5		-0.06	18.8	3.0		-0.06
	1/20/93	20.9	0.1		0.01	20.0	1.7		0.02	19.0	2.0		0.02
	1/28/93	21.2	0.8		0.00	20.2	1.9		-0.05	18.6	3.2		-0.06
	2/4/93	20.9	0.4		0.00	20.0	1.8		-0.05	17.2	3.2		-0.07
	2/12/93	20.6	0.8		0.00	20.0	1.8		-0.04	17.5	3.8		-0.05
	2/19/93	20.9	0.8		0.00	20.0	2.0		-0.02	17.5	2.8		-0.02
	2/26/93	20.8	0.5		0.00	19.8	1.4		-0.04	17.5	3.2		-0.05
	3/4/93	20.9	0.6		0.00	19.8	1.7		-0.04	17.0	3.4		-0.05
	3/11/93	20.9	0.5		0.00	20.0	1.3		-0.04	18.0	2.8		-0.05
	3/25/93	20.8	0.6	0	0.00	19.5	1.5	30	0.00	18.2	3.5	160	0.00
	4/3/93	20.8	0.6	0	0.00	20.0	1.7	40	0.00	19.0	2.9	180	-0.01
	4/8/93	20.8	0.6	0	0.00	19.8	1.2	40	0.00	18.2	3.4	180	0.00
	4/15/93	20.8	0.6	0	0.00	19.9	1.6	40	-0.01	19.0	2.8	160	-0.01
	4/22/93	20.8	0.6	0	0.00	19.9	1.6	40	0.00	18.8	2.8	180	0.00
	4/29/93	20.8	0.6	0	0.00	19.8	1.6	40	0.00	18.8	2.8	140	0.00
	5/6/93	20.9	0.5	0	0.00	19.6	1.8	30	0.00	18.2	3.0	180	0.00
	5/13/93	20.9	0.6	10	0.00	19.7	1.8	50	0.00	18.6	3.0	160	0.00
	5/20/93	20.8	0.6	0	0.00	19.7	1.9	30	0.00	18.6	3.2	160	0.00
	9/21/93	20.8	0.6	20	0.00	19.2	2.3	60	0.00	17.5	3.8	380	0.00
	10/30/93	20.9	0.5	10		19.8	2.9	40		18.5	3.8	260	

		LEVEL A (G)				LEVEL B (B)				LEVEL C (Y)			
MPT	Date	% O2	% CO2	HC (ppm)	Pressure (in water)	% O2	% CO2	HC (ppm)	Pressure (in water)	% O2	% CO2	HC (ppm)	Pressure (in water)
5	11/12/92	19.5	1.0	220		19.5	1.8	300		19.5	1.8	700	
	11/13/92	20.5	1.0	160		20.0	2.0	240		20.0	2.0	600	
	11/14/92	20.5	1.0	170		20.0	2.0	220		19.0	2.2	500	
	11/20/92	20.0	1.0	160		19.5	2.0	240		19.0	2.5	560	
	12/02/92	20.1	0.3	80		19.8	1.1	150		18.8	1.7	425	
	1/12/93	20.9	0.7			20.0	1.8			19.0	2.5		
	1/15/93	20.9	0.9			20.5	1.9			19.5			
	1/18/93	20.9	0.8		−0.05	20.1	1.8		−0.05	19.5	2.3		−0.05
	1/20/93	20.9	0.8		0.03	20.5	1.8		0.02	19.5	2.2		0.02
	1/28/93	20.9	0.8		0.00	20.2	1.3		0.01	19.8	2.2		0.00
	2/4/93	20.5	0.6		−0.05	20.0	1.5		−0.05	19.2	2.2		−0.05
	2/12/93	20.6	1.0		−0.05	20.0	2.0		−0.06	19.4	2.2		−0.06
	2/19/93	20.8	1.0		−0.03	20.2	2.1		−0.03	19.8	2.5		−0.02
	2/26/93	20.4	0.8		−0.05	20.0	1.8		−0.06	19.2	2.2		−0.06
	3/4/93	20.8	0.9		−0.05	20.2	2.0		−0.06	19.5	2.2		−0.07
	3/11/93	20.7	0.8		−0.06	20.2	1.8		−0.06	19.6	2.2		−0.07
	3/25/93	20.6	1.0	20	0.00	20.0	1.9	30	0.00	19.2	2.5	280	0.00
	4/3/93	20.1	0.9	30	0.00	19.6	1.7	60	0.00	19.0	2.1	320	0.00
	4/8/93	20.0	1.2	20	0.00	19.4	2.2	30	0.00	18.5	2.8	380	0.00
	4/15/93	20.0	0.9	10	0.00	19.4	1.8	60	0.00	18.9	2.2	340	0.00
	4/22/93	20.0	0.9	40	0.00	19.4	1.8	60	0.00	19.0	2.1	320	0.00
	4/29/93	20.0	0.9	30	0.00	19.5	1.7	50	0.00	18.8	2.2	340	0.00
	5/6/93	20.0	0.9	20		19.3	1.9	30		18.6	2.2	420	
	5/13/93	20.0	1.0	20	0.01	19.2	1.9	40	0.01	18.7	2.2	460	0.01
	5/20/93	20.0	1.4	20	0.00	19.1	2.2	60	0.00	18.7	2.9	440	0.00
	9/21/93	20.2	1.9	30	0.00	19.4	3.8	60	0.00	18.5	4.0	780	0.00
	10/30/93	20.5	0.8	40		20.0	1.6	40		19.0	3.0	920	
6	11/12/92	20.9	0.3	160		20.9	0.5	180		20.0	1.0	300	
	11/13/92	20.9	0.7	110		20.5	1.0	180		20.0	1.3	260	
	11/14/92	20.5	0.7	80		20.0	1.3	150		20.0	1.5	220	
	11/20/92	20.9	0.7	80		20.0	1.3	190		19.0	2.0	350	
	12/02/92	20.9	0.1	30		20.0	0.6	130		19.0	1.1	350	
	1/12/93	20.8	0.5			20.5	1.1			19.8	2.0		
	1/15/93	20.8	0.2			20.5	1.3			19.0	2.0		
	1/18/93	20.9	0.5		−0.01	20.8	1.1		−0.01	19.0	2.2		−0.01
	1/20/93	20.9	0.2		0.01	20.5	1.0		0.03	19.0	2.1		0.01
	1/28/93	20.9	1.0		−0.01	20.7	1.8		−0.01	19.8	1.8		−0.01
	2/4/93	20.4	0.5		−0.01	19.8	1.2		−0.01	19.8	2.2		−0.02
	2/12/93	20.9	0.4		0.00	20.2	1.6		0.00	19.2	2.8		0.00
	2/19/93	20.9	0.8		0.00	20.5	2.1		0.01	19.4	3.2		0.02
	2/26/93	20.8	0.5		−0.01	20.2	0.9		−0.01	19.2	2.2		−0.01
	3/4/93	20.9	0.5		−0.01	20.4	1.2		−0.01	20.0	2.0		−0.01
	3/11/93	20.7	0.7		0.00	20.2	1.0		−0.01	19.2	2.2		−0.01
	3/25/93	20.8	0.6	0	0.00	20.2	1.2	20	0.00	19.2	2.2	260	0.00
	4/3/93	20.8	0.6	0	0.00	20.2	1.0	40	0.00	19.8	1.8	300	0.00
	4/8/93	20.8	0.5	10	0.00	20.0	0.9	30	0.00	19.2	2.2	360	0.00
	4/15/93	20.8	0.6	0	0.00	20.0	1.0	20	0.00	19.6	1.7	300	0.00
	4/22/93	20.7	0.6	20	0.00	20.0	1.0	50	0.00	19.7	1.7	320	0.00
	4/29/93	20.8	0.6	10	0.00	20.1	0.9	40	0.00	19.5	1.9	300	0.00
	5/6/93	20.6	0.6	20.0		20.00	1.0	20.0		19.50	1.7	360.0	
	5/13/93	20.8	0.7	10	0.00	20.1	1.0	30	0.00	19.7	1.8	320	0.00
	5/20/93	20.8	0.9	20	0.00	20.1	1.2	40	0.00	19.7	2.1	300	0.00
	9/21/93	20.8	0.7	60	0.00	19.9	2.0	40	0.00	19.0	3.1	540	0.00
	10/30/93	20.9	0.5	40		20.3	1.0	40		19.4	2.1	320	

		LEVEL A (G)				LEVEL B (B)				LEVEL C (Y)			
MPT	Date	% O2	% CO2	HC (ppm)	Pressure (in water)	% O2	% CO2	HC (ppm)	Pressure (in water)	% O2	% CO2	HC (ppm)	Pressure (in water)
7	11/12/92	18.0	3.0	620		7.0	9.0	850					
	11/13/92	17.5	3.2	260		5.0	10.0	580					
	11/14/92	18.0	3.0	220		4.5	11.5	560		1.0			
	11/20/92	19.0	0.6	10		5.5	0.7	90		1.0	0.8	1500	
	12/02/92	17.1	0.1	75		4.9	0.8	175		1.0	0.8	1000	
	1/12/93	18.5	0.7			9.0	4.0			1.5	2.7		
	1/15/93	18.5	0.8			9.0	4.0			1.5	3.0		
	1/18/93	18.0	1.0		0.00	9.0	4.5		0.00	1.0	3.0		0.00
	1/20/93	19.0	1.0		0.01	3.5	4.3		0.03	1.0	3.0		0.01
	1/28/93	17.2	1.3		0.00	11.2	2.8		0.00	2.8	3.5		0.02
	2/4/93	16.8	1.5		0.00	6.2	5.8		0.00	0.5	3.8		0.20
	2/12/93	17.2	2.5		0.01	6.5	6.8		0.01	0.5	5.2		0.30
	2/19/93	17.2	2.2		0.01	6.0	7.5		0.02	1.4	5.0		−0.50
	2/26/93	17.5	2.4		0.00	7.0	6.8		0.00	0.1	5.0		−0.45
	3/4/93	17.8	2.2		0.00	7.0	6.2		0.00	0.0	6.2		−0.35
	3/11/93	17.8	2.3		0.00	7.2	7.5		0.00	0.0	6.8		−0.20
	3/25/93	18.0	2.2	50	0.01	5.5	8.5	120	0.01	1.3	6.8	1400	−0.50
	4/3/93	13.0	1.6	80	0.00	1.4	7.5	110	0.00	1.7	6.8	740	−0.35
	4/8/93	15.0	1.8	50	−0.10	0.2	7.0	120	0.07	0.0	0.9	1000	−0.30
	4/15/93	18.0	1.3	40	0.00	5.0	6.8	110	0.01	2.8	6.5	880	−0.25
	4/22/93	18.6	1.7	40	0.00	8.4	6.8	80	0.01	1.0	7.5	980	−0.30
	4/29/93	18.4	1.9	40	0.00	8.2	7.2	80	0.00	2.5	7.2	980	2.00
	5/6/93	18.5	2.0	200		8.7	7.5	100		1.7	8.0	780	
	5/13/93	18.7	2.0	320	0.00	6.6	10.0	100	0.00	3.8	7.6	960	−4.00
	5/20/93	18.3	2.8	580	0.00	3.3	10.1	820	0.00	6.8	12.0	220	−0.15
	9/21/93	18.0	4.1	60	0.00	3.5	25.0	180	−0.25	1.0	25.0	1200	−0.35
	10/30/93 not measured												
8	11/12/92	20.5	0.5	190		20.5	0.8	220		19.0	2.0	620	
	11/13/92	20.9	0.7	170		20.5	0.8	280		19.0	2.2	560	
	11/14/92	20.0	0.7	280		19.0	0.8	360		18.5	2.5	610	
	11/16/92	20.5	0.8	160		20.0	1.0	190		19.0	2.5	450	
	11/17/92	20.9	0.6	120		20.5	0.8	210		19.0	2.0	480	
	11/18/92									19.0	2.5	450	
	11/20/92	20.9	0.8	100		18.0	0.6	110		19.5	0.8	110	
	12/02/92	20.9	0.1	50		20.5	0.6	100		18.8	1.5	425	
	1/12/93	20.5	0.5			20.5	1.2			19.5	2.0		
	1/15/93	20.8	0.5			20.7	1.2			19.0	2.5		
	1/18/93	20.8	0.5		0.00	20.5	1.2		0.00	18.0	2.8		0.00
	1/20/93	20.9	0.5		0.02	20.5	1.2		0.01	19.0	2.5		0.00
	1/28/93	20.9	1.0		−0.01	20.6	1.8		−0.01	19.2	2.0		−0.01
	2/4/93	20.2	0.5		0.00	20.0	1.1		0.00	17.2	2.4		0.00
	2/12/93	20.8	0.8		0.00	20.4	1.2		−0.01	18.8	2.4		−0.01
	2/19/93	20.9	0.8		0.00	20.5	1.3		0.01	19.0	3.0		0.01
	2/26/93	20.8	0.6		0.00	20.5	0.9		0.00	19.2	2.5		0.00
	3/4/93	20.8	0.7		0.00	20.1	1.2		−0.01	19.2	2.6		−0.01
	3/11/93	20.8	0.7		0.00	20.5	1.0		−0.01	19.0	2.4		−0.01
	3/25/93	20.6	0.7	0	0.00	20.8	0.9	40	0.00	20.0	2.0	220	0.00
	4/3/93	20.7	0.7	10	0.00	20.4	1.0	40	0.00	19.7	2.2	240	0.00
	4/8/93	20.7	0.7	20	−0.01	20.2	1.0	30	−0.01	18.8	2.4	300	−0.01
	4/15/93	20.7	0.7	20	0.00	20.3	1.0	50	0.00	19.6	2.1	240	0.00
	4/22/93	20.7	0.7	20	0.00	20.1	0.9	40	0.00	19.4	2.1	240	0.00
	4/29/93	20.7	0.7	20	0.00	20.2	0.9	40	0.00	19.4	2.1	240	0.00
	5/6/93	20.6	0.7	0		20.1	0.9	10		19.0	2.0	280	
	5/13/93	20.8	0.7	20	0.00	20.3	1.0	40	−0.01	19.5	2.1	220	−0.01
	5/20/93	20.7	0.9	20	0.00	20.1	1.2	30	0.00	19.2	2.2	220	0.00
	9/21/93	20.9	0.7	10	−0.01	20.2	2.0	40	−0.01	19.1	3.2	510	−0.01
	10/30/93	20.8	0.6	40		20.0	1.1	60		19.1	2.2	320	

		LEVEL A (G)				LEVEL B (B)				LEVEL C (Y)			
MPT	Date	% O2	% CO2	HC (ppm)	Pressure (in water)	% O2	% CO2	HC (ppm)	Pressure (in water)	% O2	% CO2	HC (ppm)	Pressure (in water)
9	11/12/92	20.0	0.7	180		19.0	1.0	200		17.5	3.0	280	
	11/13/92	20.0	0.8	140		19.5	1.0	160		17.0	3.0	280	
	11/14/92	20.0	1.0	140		19.5	1.5	180		16.0	3.5	280	
	11/16/92	20.0	1.0	120		20.0	1.8	180		16.0	4.5	280	
	11/17/92	20.5	0.8	140		19.5	1.0	180		16.5	4.0	290	
	11/18/92									16.5	3.7	280	
	11/20/92	20.5	1.0	140		19.5	2.0	210		16.5	4.5	300	
	12/02/92	20.1	0.5	70		19.1	1.3	140		9.9	7.5	325	
	1/12/93												
	1/15/93	20.5	0.9			19.0	2.9			8.5	11.0		
	1/18/93	20.0	1.0		0.00	18.8	2.8		0.00	8.0	12.0		-0.01
	1/20/93	20.0	0.9		0.01	18.5	2.5		0.02	8.0	11.5		0.02
	1/28/93	20.6	1.7		0.00	19.2	2.5		-0.02	8.5	11.0		-0.01
	2/4/93	20.0	0.9		0.00	18.6	2.2		0.00	7.9	10.2		0.00
	2/12/93	20.6	0.8		0.02	19.2	2.2		0.01	8.4	9.5		0.00
	2/19/93	20.4	1.2		0.01	19.0	1.8		0.00	8.5	10.2		0.00
	2/26/93	20.5	0.8		0.00	19.0	2.2		0.00	8.2	11.4		0.00
	3/4/93	20.7	0.8		0.00	19.2	2.4		0.00	8.5	10.5		0.00
	3/11/93	20.2	0.8		0.00	18.9	2.2		-0.01	9.5	10.5		-0.01
	3/25/93	20.8	0.8	20	-0.01	19.0	2.2	40	-0.01	11.2	9.0	80	-0.01
	4/3/93	20.7	0.7	10	0.00	19.2	1.8	50	0.00	11.8	8.8	120	0.00
	4/8/93	20.6	0.8	20	-0.01	19.8	1.4	40	-0.01	10.8	9.8	100	-0.01
	4/15/93	20.7	0.8	20	0.00	19.8	1.4	50	0.00	15.0	5.8	100	0.00
	4/22/93	20.7	0.7	20	0.00	19.0	1.4	40	-0.02	11.2	7.4	110	-0.02
	4/29/93	20.6	0.8	20	-0.01	19.0	1.3	40	-0.02	10.9	8.0	100	-0.02
	5/6/93	20.7	0.6	20		20.2	1.0	20		11.2	8.1	90	
	5/13/93	20.8	0.7	10	0.00	19.8	1.4	30	-0.01	11.5	8.5	90	-0.01
	5/20/93	20.8	0.7	10	0.00	19.3	1.9	40	0.00	10.2	10.2	100	0.00
	9/21/93	20.5	0.6	20	0.00	18.2	2.8	40	0.00	7.8	11.2	100	0.00
	10/30/93	20.7	0.5	140		18.0	2.8	120		8.8	11.8	120	
10	11/12/92	20.0	0.6	200		19.0	1.5	300		12.0	5.4	680	
	11/13/92	20.0	0.8	160		19.0	2.0	240		10.5	7.0	620	
	11/14/92	20.0	0.8	160		19.0	2.0	260		10.0	7.5	620	
	11/20/92	20.5	0.8	100		18.0	0.6	110		12.5	0.8	110	
	12/02/92	20.8	0.1	70		17.0	0.5	150		7.1	0.8	200	
	1/12/93	20.5	0.5			18.0	1.0			6.9	5.8		
	1/15/93	20.9	0.6			18.5	1.2			7.0	6.0		
	1/18/93	20.8	0.7		0.00	18.0	1.3		0.00	6.0	6.5		0.00
	1/20/93	20.0	0.5		0.02	17.8	1.0		0.01	6.0	6.5		0.02
	1/28/93	20.6	1.2		0.00	18.0	2.0		0.00	6.0	9.0		0.00
	2/4/93	19.9	0.8		0.00	17.2	1.8		0.00	5.5	9.8		0.00
	2/12/93	20.4	0.7		0.00	17.5	1.5		0.00	5.5	7.5		0.00
	2/19/93	20.6	1.2		0.00	17.8	2.3		0.01	5.5	11.0		0.01
	2/26/93	20.4	0.9		0.00	17.5	2.4		0.00	5.5	10.5		0.00
	3/4/93	20.2	0.9		0.00	17.4	2.5		0.00	5.5	10.5		0.00
	3/11/93	20.0	0.8		0.00	17.2	2.5		0.00	5.5	11.8		0.00
	3/25/93	20.4	0.9	20	0.00	18.0	2.5	50	0.00	8.0	10.5	160	0.00
	4/3/93	20.0	0.9	40	0.00	17.5	2.8	60	0.00	7.0	10.0	100	0.00
	4/8/93	20.0	1.0	20	0.00	17.6	2.0	50	0.00	6.0	11.0	140	0.00
	4/15/93	20.0	0.9	40	0.00	17.8	2.8	70	0.00	7.5	11.2	100	0.00
	4/22/93	20.0	1.0	40	0.00	17.8	2.8	60	0.00	7.0	10.4	90	0.00
	4/29/93	20.0	0.9	30	0.00	16.2	3.0	40	0.00	6.8	11.0	80	0.00
	5/6/93	20.0	1.0	40		17.4	3.2	40		6.2	11.8	160	
	5/13/93	20.2	1.1	20	0.00	17.8	3.3	40	0.00	7.2	11.8	80	0.00
	5/20/93	20.1	1.3	40	0.00	17.6	3.9	60	0.00	7.5	14.5	100	0.00
	9/21/93	20.6	0.7	20	0.00	17.4	3.9	60	0.00	6.0	14.0	180	0.00
	10/30/93	20.8	0.5	20		17.8	3.6	140		8.2	14.0	160	

		LEVEL A (G)				LEVEL B (B)				LEVEL C (Y)			
MPT	Date	% O2	% CO2	HC (ppm)	Pressure (in water)	% O2	% CO2	HC (ppm)	Pressure (in water)	% O2	% CO2	HC (ppm)	Pressure (in water)
11	11/12/92	20.9	0.5	160		20.5	0.5	190		20.5	0.6	240	
	11/13/92	20.5	0.6	120		20.5	0.8	140		19.0	1.1	400	
	11/14/92	20.9	0.5	100		20.0	0.7	140		19.0	2.0	400	
	11/20/92	20.9	0.6	80		20.0	1.0	180		19.0	2.8	430	
	12/02/92	20.9	0.1	50		19.8	1.0	190		17.0	2.9	490	
	1/12/93	20.8	0.5			20.0	1.4						
	1/15/93	20.9	0.5			20.5	1.5			9.0	5.0		
	1/18/93	20.9	0.5		0.00	20.0	1.4		−0.02	7.0	7.3		−9.50
	1/20/93	20.8	0.2		0.00	20.0	1.3		0.00	9.0	5.0		−2.50
	1/28/93	21.2	1.3		0.00	20.6	1.8		0.00	8.5	5.9		0.01
	2/4/93	20.7	0.8		0.00	20.0	1.3		0.00	7.2	5.5		−10.00
	2/12/93	20.8	0.5		0.00	20.2	1.2		0.00	7.0	5.8		−9.00
	2/19/93	20.9	0.9		0.02	20.2	2.0		0.01	16.5	5.0		−10.00
	2/26/93	20.6	0.7		0.00	20.0	1.2		0.00	16.0	4.5		−12.00
	3/4/93	20.7	0.7		0.00	20.0	1.8		0.00	16.2	5.4		−12.00
	3/11/93	20.8	0.7		0.00	20.0	1.5		0.00	16.2	4.9		−11.00
	3/25/93	20.7	0.8	20	0.00	20.0	1.8	30	0.00	10.5	5.8	260	−9.00
	4/3/93	20.6	0.7	20	0.00	20.0	1.4	40	0.00	17.0	3.8	320	−8.00
	4/8/93	20.6	0.8	20	0.00	19.9	1.8	40	0.00	12.2	4.3	320	−3.00
	4/15/93	20.6	0.8	10	0.00	19.9	1.4	60	0.00	16.5	4.1	360	−8.00
	4/22/93	20.6	0.8	20	0.00	19.9	1.4	50	0.00	16.5	4.0	340	−8.00
	4/29/93	20.6	0.8	20	0.00	19.8	1.5	50	0.00	15.8	4.3	360	−11.00
	5/6/93	20.5	0.8	10		19.9	1.6	20		8.2	5.5	180	
	5/13/93	20.8	0.9	20	0.00	20.0	1.8	40	0.00	16.5	4.2	300	−9.00
	5/20/93	20.7	1.0	30	0.00	20.0	2.0	60	0.00	16.2	5.0	360	−12.00
	9/21/93	20.8	0.6	10	0.00	19.5	2.2	50	0.00	15.5	5.0	1200	0.00
	10/30/93	20.9	0.5	100		20.0	1.8	40		16.4	5.5	1000	
12	11/12/92	20.5	0.5	140		20.0	0.5	160		20.0	1.0	200	
	11/13/92	20.9	0.5	100		20.5	0.6	120		20.0	0.8	160	
	11/14/92	20.9	0.5	90		20.5	0.7	100		19.5	1.0	160	
	11/20/92	20.9	0.6	80		20.5	0.7	120		19.0	1.3	220	
	12/02/92	20.9	0.1	50		20.5	0.5	150		17.7	2.5	350	
	1/12/93	20.9	0.5			20.8	0.8			17.0	3.4		
	1/15/93	20.9	0.5			20.8	0.8			17.0	3.8		
	1/18/93	20.9	0.5		0.00	20.8	0.9		−0.01	16.0	4.0		−0.01
	1/20/93	20.5	0.3		0.00	20.0	0.8		0.01	16.2	3.5		−0.04
	1/28/93	21.0	1.2		0.00	20.6	1.5		0.00	16.0	3.5		0.00
	2/4/93	20.8	0.5		0.00	20.2	0.8		0.00	15.5	3.8		0.00
	2/12/93	20.8	0.8		0.00	20.5	1.0		0.00	15.8	3.8		0.00
	2/19/93	20.8	0.9		0.03	20.4	1.2		0.03	16.2	4.2		0.03
	2/26/93	20.7	0.7		0.00	20.2	0.9		0.00	17.0	4.2		0.00
	3/4/93	20.6	0.7		0.00	20.2	1.0		0.00	16.5	4.2		0.00
	3/11/93	20.8	0.6		0.00	20.2	1.0		0.00	16.0	4.4		0.00
	3/25/93	20.8	0.7	10	0.00	20.5	1.0	20	0.00	16.8	3.8	90	0.00
	4/3/93	20.5	0.7	20	0.00	20.1	0.9	40	0.00	17.5	3.3	120	0.00
	4/8/93	20.4	0.8	20	0.00	20.0	1.0	30	0.00	16.0	3.8	110	0.00
	4/15/93	20.7	0.7	20	0.00	20.0	1.0	30	0.00	17.5	3.3	120	0.00
	4/22/93	20.7	0.8	20	0.00	20.0	1.0	30	0.00	17.0	2.3	110	0.00
	4/29/93	20.7	0.8	20	0.00	20.0	1.0	40	0.00	17.0	3.4	120	0.00
	5/6/93	20.5	0.7	10		20.1	0.9	20		16.3	3.9	100	
	5/13/93	20.7	0.8	20	0.00	20.2	1.0	30	0.00	17.0	3.6	110	0.00
	5/20/93	20.8	0.8	20	0.00	20.2	1.2	30	0.00	17.0	3.9	100	0.00
	9/21/93	20.8	0.6	10	0.00	20.1	1.4	40	0.00	15.3	5.0	220	0.00
	10/30/93	20.9	0.5	0		20.6	0.9	20		16.6	5.0	140	

		LEVEL A (G)				LEVEL B (B)				LEVEL C (Y)			
MPT	Date	% O2	% CO2	HC (ppm)	Pressure (in water)	% O2	% CO2	HC (ppm)	Pressure (in water)	% O2	% CO2	HC (ppm)	Pressure (in water)
13	11/12/92	20.5	0.5	160		20.0	0.8	200		19.5	1.0	260	
	11/13/92	20.5	0.7	120		20.0	0.8	180		20.0	1.0	210	
	11/14/92	20.9	0.5	130		20.5	0.9	160		20.0	1.0	210	
	11/20/92	20.9	1.0	40		20.0	1.5	200		20.0	1.5	280	
	12/02/92	20.9	0.1	100		20.1	0.8	170		19.0	1.5	500	
	1/12/93	20.9	0.5			20.5	1.0			19.5	2.0		
	1/15/93	20.9	0.5			20.5	1.1			19.0	2.3		
	1/18/93	20.5	0.7		0.00	20.0	1.2		−1.20	18.5	2.5		−0.18
	1/20/93	20.8	0.5		0.00	20.1	1.0		0.00	19.0	2.1		0.00
	1/28/93	21.0	1.3		0.00	20.2	1.8		0.00	19.2	3.0		0.00
	2/4/93	20.6	0.8		−0.01	20.1	1.2		−0.01	18.6	2.5		−0.01
	2/12/93	20.9	0.5		0.00	20.5	1.8		0.00	19.2	2.0		−0.01
	2/19/93	20.9	0.8		0.00	20.6	1.5		0.00	19.5	2.6		0.00
	2/26/93	20.7	0.7		0.00	20.2	0.9		0.00	19.8	2.0		0.00
	3/4/93	20.9	0.7		0.00	20.6	0.8		−0.01	19.2	2.0		−0.01
	3/11/93	20.8	0.6		0.00	20.3	1.0		−0.01	19.2	2.2		−0.01
	3/25/93	20.8	0.7	0	0.00	20.4	1.1	20	0.00	19.2	2.2	160	0.00
	4/3/93	20.7	0.7	20	0.00	20.2	1.1	40	0.00	19.9	1.7	120	0.00
	4/8/93	20.6	0.8	20	0.00	20.0	1.0	40	0.00	19.0	1.6	140	0.00
	4/15/93	20.6	0.7	10	−0.01	20.0	1.0	40	−0.01	19.9	1.6	100	−0.01
	4/22/93	20.7	0.7	20	0.00	20.1	1.0	40	0.00	19.7	1.8	140	0.00
	4/29/93	20.7	0.7	20	0.00	20.0	1.0	40	0.00	19.8	1.7	140	0.00
	5/6/93	20.7	0.7	20		20.0	1.0	20		19.1	1.9	200	
	5/13/93	20.8	0.7	20	0.00	20.2	1.0	40	0.00	20.0	1.5	120	0.00
	5/20/93	20.7	0.8	20	0.00	20.1	1.1	40	0.00	19.7	1.8	160	0.00
	9/21/93	20.7	0.7	20	0.00	20.0	1.8	40	0.00	18.9	2.2	460	0.00
	10/30/93	20.8	0.6	10		20.2	1.2	40		19.2	2.2	360	
14	11/12/92	20.5	0.5	160		20.5	0.7	190		19.0	1.8	440	
	11/13/92	20.9	0.5	120		20.9	0.5	120		20.0	0.7	210	
	11/14/92	20.5	0.5	110		20.5	0.5	140		20.5	0.7	200	
	11/20/92	20.5	0.6	60		20.0	0.8	140		20.0	0.9	250	
	12/02/92	20.9	0.5	50		20.9	0.2	110		20.5	1.0	220	
	1/12/93	20.9	0.7			20.7	0.8			20.0	1.5		
	1/15/93	20.9	0.4			20.9	0.9			19.8	1.8		
	1/18/93	20.9	0.5		−0.02	20.9	0.9		−0.03	18.5	2.0		−0.03
	1/20/93	20.7	0.2		0.15	20.1	0.8		0.15	19.0	1.5		0.01
	1/28/93	21.2	1.2		−0.01	20.9	1.4		−0.01	19.8	2.0		−0.02
	2/4/93	20.8	0.5		−0.01	20.5	0.8		−0.02	19.2	2.0		−0.02
	2/12/93	20.9	0.8		−0.01	20.7	1.2		−0.01	19.5	2.0		−0.02
	2/19/93	20.9	0.8		0.00	20.7	1.1		−0.01	20.0	2.1		−0.01
	2/26/93	20.8	0.6		−0.01	20.5	0.8		−0.01	20.0	1.4		−0.02
	3/4/93	20.8	0.7		−0.01	20.7	0.9		−0.02	19.8	2.0		−0.02
	3/11/93	20.8	0.7		−0.02	20.4	0.8		−0.02	19.5	2.2		−0.03
	3/25/93	20.9	0.6	10	−0.02	20.7	0.9	20	−0.02	19.4	1.8	160	−0.03
	4/3/93	20.7	0.6	20	−0.01	20.5	0.8	30	−0.02	20.0	1.3	180	−0.02
	4/8/93	20.7	0.7	20	−0.01	20.2	0.9	20	−0.02	19.4	1.8	140	−0.02
	4/15/93	20.6	0.7	10	−0.02	20.6	0.8	20	−0.03	20.1	1.3	140	−0.03
	4/22/93	20.7	0.7	10	−0.01	20.4	0.7	20	−0.02	20.2	1.2	60	−0.02
	4/29/93	20.7	0.7	20	−0.03	20.5	0.8	30	−0.04	20.0	1.2	110	−0.05
	5/6/93	20.7	0.7	20		20.3	0.8	20		19.5	1.1	120	
	5/13/93	20.7	0.8	20	−0.01	20.5	0.8	40	−0.02	20.0	1.2	110	−0.03
	5/20/93	20.7	0.8	20	0.00	20.5	0.9	30	0.00	20.2	1.2	120	0.00
	9/21/93	20.8	0.6	10	0.00	20.2	1.0	20	0.00	19.5	1.8	320	0.00
	10/30/93	20.8	0.5	0		20.5	0.8	20		19.8	1.4	220	

		LEVEL A (G)				LEVEL B (B)				LEVEL C (Y)			
MPT	Date	% O2	% CO2	HC (ppm)	Pressure (in water)	% O2	% CO2	HC (ppm)	Pressure (in water)	% O2	% CO2	HC (ppm)	Pressure (in water)
15	11/12/92	20.5	0.5	140		20.0	1.0	200		20.0	1.5	300	
	11/13/92	20.9	0.5	100		20.5	1.0	180		20.0	1.1	260	
	11/14/92	20.5	0.5	120		20.0	1.0	180		19.5	2.0	320	
	11/20/92	20.5	0.6	80		20.0	1.3	180		18.0	2.5	430	
	12/02/92	20.9	0.1	75		20.0	0.8	175		19.2	1.2	360	
	1/12/93	20.9	0.5			20.5	1.2			19.5	2.5		
	1/15/93	20.8	0.5			20.6	1.5			16.0	2.5		
	1/18/93	20.9	0.2		−0.03	20.2	1.3		−0.05	15.5	3.5		−0.06
	1/20/93	20.9	0.2		0.00	20.5	1.2		0.01	18.0	2.5		0.00
	1/28/93	20.9	1.2		−0.02	20.9	1.4		−0.01	19.8	2.0		−0.02
	2/4/93	20.8	0.6		−0.03	20.2	1.5		−0.06	17.0	3.0		−0.06
	2/12/93	20.8	0.8		−0.02	20.4	2.0		−0.05	17.2	2.8		−0.05
	2/19/93	20.9	0.8		−0.02	20.5	1.6		−0.04	19.5	2.8		−0.04
	2/26/93	20.8	0.6		−0.03	20.2	1.2		−0.05	19.0	2.2		−0.05
	3/4/93	20.9	0.6		−0.03	20.5	1.4		−0.06	19.5	2.2		−0.06
	3/11/93	20.8	0.6		−0.03	20.3	1.2		−0.05	19.5	2.4		−0.05
	3/25/93	20.9	0.6	0	−0.03	20.3	1.4	20	−0.05	18.5	2.4	300	−0.05
	4/3/93	20.8	0.6	10	−0.02	20.4	1.2	60	−0.04	19.9	2.0	280	−0.04
	4/8/93	20.8	0.6	10	0.00	20.1	1.2	40	−0.04	18.2	2.5	220	−0.03
	4/15/93	20.9	0.6	0	−0.04	20.5	1.2	40	−0.06	20.0	2.0	200	−0.06
	4/22/93	20.8	0.6	10	−0.03	20.6	1.0	30	−0.05	19.8	2.0	240	−0.05
	4/29/93	20.8	0.6	10	−0.04	20.2	1.0	40	−0.07	19.3	2.1	260	−0.07
	5/6/93	20.8	0.6	0		20.2	1.1	20		18.5	2.2	320	
	5/13/93	20.8	0.6	20	−0.02	20.3	1.2	40	−0.04	19.8	2.2	260	−0.04
	5/20/93	20.8	0.6	0	0.00	20.2	1.2	40	0.00	19.5	2.3	300	0.00
	9/21/93	20.7	0.6	10	0.00	20.0	1.5	40	0.00	18.8	2.6	540	0.00
	10/30/93	20.9	0.5	20		20.6	1.1	40		19.5	2.6	580	
16	11/12/92	19.5	1.2	230		19.0	1.8	260		19.0	2.1	320	
	11/13/92	20.0	1.5	200		20.5	1.0	220		19.5	1.5	540	
	11/14/92	20.0	1.5	200		20.0	2.5	200		19.0	2.5	260	
	11/16/92	19.5	2.0	200		19.5	2.5	230		18.5	3.5	310	
	11/17/92	20.5	1.0	180		20.0	2.0	230		19.0	3.0	340	
	11/18/92									19.0	2.8	340	
	11/20/92	20.0	1.5	200		19.0	2.5	260		18.5	3.5	360	
	12/02/92	20.8	2.0	120		19.5	2.1	210		17.1	4.0	500	
	1/12/93	20.8	0.8			20.0	1.8			18.5	3.0		
	1/15/93	20.8	0.8			20.8	2.0			20.0	3.5		
	1/18/93	20.9	0.8		−0.08	20.8	2.0		−0.08	20.0	3.2		−0.10
	1/20/93	20.9	0.7		0.00	20.8	1.9		0.00	20.0	3.1		0.00
	1/28/93	21.2	0.8		−0.04	21.0	2.0		−0.06	20.1	3.1		−0.06
	2/4/93	20.7	0.6		−0.08	20.4	1.5		−0.08	19.8	2.6		−0.09
	2/12/93	20.8	0.4		−0.06	20.6	0.8		−0.08	20.0	1.3		−0.15
	2/19/93	20.8	0.8		−0.05	20.7	1.8		−0.08	20.2	2.8		−0.15
	2/26/93	20.9	0.6		−0.07	20.7	1.3		−0.10	20.0	2.5		−0.12
	3/4/93	20.8	0.7		−0.10	20.6	1.4		−0.15	20.3	1.8		−0.15
	3/11/93	20.8	0.6		−0.07	20.5	1.0		−0.10	20.1	1.8		−0.12
	3/25/93	20.8	0.6	10	0.00	20.2	1.3	30	0.00	19.1	1.9	130	0.00
	4/3/93	20.1	0.7	10	0.00	19.9	1.2	40	0.00	19.2	1.9	160	0.00
	4/8/93	20.2	0.8	20	0.00	19.8	1.2	40	−0.01	18.6	1.8	140	−0.01
	4/15/93	20.2	0.8	20	0.00	20.0	1.2	40	−0.01	19.0	1.9	140	−0.01
	4/22/93	20.2	0.8	20	0.00	19.9	1.2	40	0.00	19.0	1.9	140	0.00
	4/29/93	20.2	0.8	20	0.00	20.0	1.2	40	0.00	18.8	2.0	160	0.00
	5/6/93	20.2	0.9	20		19.9	1.2	20		18.6	2.0	190	
	5/13/93	20.6	0.9	20	0.00	19.9	1.3	40	0.00	19.0	2.1	140	0.00
	5/20/93	20.3	1.0	20	0.00	19.9	1.3	30	0.00	18.7	2.2	180	0.00
	9/21/93	20.3	0.9	20	0.00	19.6	1.9	40	0.00	17.8	3.1	560	0.00
	10/30/93	20.8	0.7	20		19.9	1.5	40		16.8	3.2	440	

		LEVEL A (G)				LEVEL B (B)				LEVEL C (Y)			
MPT	Date	% O2	% CO2	HC (ppm)	Pressure (in water)	% O2	% CO2	HC (ppm)	Pressure (in water)	% O2	% CO2	HC (ppm)	Pressure (in water)
17	11/12/92	20.9	0.5	200		19.5	0.9	240		19.5	1.3	630	
	11/13/92	20.9	0.5	130		20.5	1.0	220		19.5	1.5	540	
	11/14/92	20.5	0.6	100		20.0	1.0	180		19.0	2.0	400	
	11/16/92	20.9	0.8	120		20.0	1.5	220		19.0	2.3	480	
	11/17/92	20.9	0.6	140		20.0	1.0	220		19.5	2.0	500	
	11/18/92									19.5	2.0	450	
	11/20/92	20.9	0.6	80		20.0	1.5	200		19.5	2.0	480	
	12/02/92	20.9	0.5	90		20.5	1.0	210		16.0	2.0	800	
	1/12/93	20.9	0.5			20.5	1.2			19.5	2.5		
	1/15/93	20.9	0.2			20.8	1.1			19.5	2.9		
	1/18/93	20.9	0.2		−0.04	20.9	0.8		−0.10	20.0	1.7		−0.10
	1/20/93	20.9	0.2		0.02	20.8	0.8		0.00	20.0	1.7		0.00
	1/28/93	20.9	1.0		−0.03	20.6	1.5		−0.04	19.5	2.5		−0.04
	2/4/93	20.9	0.4		0.00	20.4	0.8		−0.06	18.6	2.8		−0.06
	2/12/93	20.9	0.4		−0.05	20.7	1.2		−0.07	20.1	2.5		−0.07
	2/19/93	20.9	0.8		−0.02	20.8	0.9		−0.02	19.5	2.4		−0.04
	2/26/93	20.9	0.5		−0.05	20.7	0.7		−0.07	20.0	1.6		−0.07
	3/4/93	20.9	0.5		−0.05	20.7	0.8		−0.08	19.8	1.8		−0.08
	3/11/93	20.8	0.6		−0.05	20.7	0.8		−0.08	20.2	1.0		−0.08
	3/25/93	20.9	0.6	10	−0.01	20.4	0.7	20	−0.02	19.0	1.8	160	−0.02
	4/3/93	20.8	0.6	0	0.00	20.5	0.8	20	−0.02	19.6	1.8	160	−0.02
	4/8/93	20.8	0.6	0	−0.02	20.5	0.8	30	−0.02	19.2	2.4	200	−0.02
	4/15/93	20.8	0.5	0	−0.02	20.5	0.8	20	−0.03	20.0	1.4	120	−0.03
	4/22/93	20.8	0.5	10	−0.02	20.4	0.8	30	−0.03	19.8	1.3	120	−0.03
	4/29/93	20.8	0.5	0	−0.03	20.4	0.8	20	−0.04	19.7	1.4	120	−0.04
	5/6/93	20.7	0.6	10		20.2	0.8	20		19.8	1.3	140	
	5/13/93	20.9	0.6	0	−0.01	20.4	0.8	20	−0.02	19.3	1.8	160	−0.02
	5/20/93	20.8	0.7	20	0.00	20.3	0.9	40	0.00	19.2	2.1	200	0.00
	9/21/93	20.8	0.6	0	−0.01	20.4	1.7	40	−0.03	18.2	3.3	640	−0.03
	10/30/93	20.9	0.5	0		20.1	0.9	40		18.9	2.2	320	

		LEVEL A (G)				LEVEL B (B)				LEVEL C (Y)			
MPT	Date	% O2	% CO2	HC (ppm)	Pressure (in water)	% O2	% CO2	HC (ppm)	Pressure (in water)	% O2	% CO2	HC (ppm)	Pressure (in water)
18	11/12/92	20.9	0.5	40		20.0	0.5	180		20.0	0.5	240	
	11/13/92	20.9	0.5	90		20.9	0.6	120		20.5	0.9	180	
	11/14/92	20.9	0.5	80		20.5	0.8	110		19.5	1.0	180	
	11/16/92	20.9	0.7	100		20.5	0.9	120		20.0	1.5	230	
	11/17/92	20.9	0.5	100		20.5	0.6	160		20.0	1.0	270	
	11/18/92									20.0	1.0	240	
	11/20/92	20.9	0.5	60		20.9	0.5	100		19.5	1.5	200	
	12/02/92	20.9	0.1	20		20.8	0.2	110		20.2	0.2	300	
	1/12/93	20.5	0.2			20.8	0.8				0.1		
	1/15/93	20.9	0.1			20.8	1.1			19.5	1.9		
	1/18/93	20.9	0.2		−0.13	20.8	0.6		−0.13	18.5	1.2		−0.14
	1/20/93	20.9	0.1		0.02	20.9	0.6		0.01	19.5	1.3		0.2
	1/28/93	20.9	1.0		−0.30	21.0	1.2		−0.30	16.0	1.2		−0.5
	2/4/93	20.5	0.5		−0.15	20.8	0.4		−0.15	16.5	0.8		0.00
	2/12/93	20.9	0.6		−0.10	20.8	0.5		−0.20	13.2	1.8		0.0
	2/19/93	20.9	0.5		0.00	20.9	0.8		−0.20	15.0	1.8		0.0
	2/26/93	20.8	0.5		−0.15	20.8	0.5		−0.15	19.0	1.2		0.00
	3/4/93	20.9	0.6		−0.10	20.8	0.6		−0.10	20.0	1.5		0.00
	3/11/93	20.9	0.5		−0.11	20.9	0.7		−0.14	20.6	0.8		0.0
	3/25/93	20.9	0.6	0	−0.15	20.8	0.6	0	−0.20	20.9	0.6	10	0.04
	4/3/93	20.9	0.5	0	−0.25	20.9	0.6	0	−0.25	20.8	0.6	0	0.00
	4/8/93	20.8	0.5	0	−0.20	20.7	0.6	10	−0.20	16.2	1.4	20	−0.2
	4/15/93	20.9	0.5	0	−0.20	20.8	0.6	0	−0.25	20.7	0.6	10	0.0
	4/22/93	20.9	0.5	0	−0.15	20.8	0.5	0	−0.15	20.4	0.6	20	0.00
	4/29/93	20.9	0.5	0	−0.25	20.9	0.6	0	−0.30	20.5	0.7	20	0.00
	5/6/93	20.8	0.5	0		20.7	0.5	0		16.2	1.2	0	
	5/13/93	20.9	0.5	0	−0.10	20.8	0.5	0	−0.15	20.6	0.6	10	0.0
	5/20/93	20.9	0.6	0	0.00	20.8	0.6	0	0.00	20.8	0.6	20	0.00
	9/21/93	20.9	0.5	0	−0.01	20.8	0.7	20	−0.06	20.7	0.6	30	−0.0
	10/30/93	20.9	0.5	40		20.5	0.7	40		18.9	2.2	60	
19	11/12/92	20.9	0.5	210		20.5	0.8	210		20.5	0.8	260	
	11/13/92	20.9	0.5	100		20.5	0.5	150		20.0	0.7	200	
	11/14/92	20.9	0.4	100		20.5	0.6	170		20.0	0.8	260	
	11/20/92	20.9	0.6	60		20.0	0.9	160		19.5	1.0	320	
	12/02/92	20.9	0.1	80		20.8	0.5	150		19.5	1.0	350	
	1/12/93	20.9	0.2			20.8	0.8			20.0	1.6		
	1/15/93	20.9	0.5			20.9	0.8			20.0	1.8		
	1/18/93	20.9	0.2		−0.01	20.5	0.8		−0.01	19.5	1.8		−0.01
	1/20/93	20.8	0.1		0.15	20.5	0.8		0.00	19.5	1.7		0.1
	1/28/93	21.2	1.2		−0.01	20.6	1.5		−0.02	20.0	2.0		−0.02
	2/4/93	20.9	0.4		−0.01	20.6	0.8		−0.01	19.8	1.7		−0.02
	2/12/93	20.7	0.8		0.00	20.8	1.2		−0.01	20.0	1.5		−0.01
	2/19/93	20.9	0.8		0.00	20.8	1.0		0.00	20.0	2.1		0.00
	2/26/93	20.5	0.5		0.00	20.6	0.8		−0.01	19.9	1.5		−0.01
	3/4/93	20.9	0.5		−0.01	20.7	0.8		−0.01	19.9	1.8		−0.01
	3/11/93	20.9	0.5		0.00	20.6	0.8		−0.01	19.9	2.0		−0.01
	3/25/93	20.9	0.6	0	−0.01	20.7	0.8	0	−0.02	19.8	1.8	140	−0.02
	4/3/93	20.8	0.6	0	−0.01	20.7	0.8	30	−0.02	20.0	1.5	160	−0.02
	4/8/93	20.8	0.5	0	−0.01	21.5	0.8	20	−0.02	19.8	1.8	140	−0.02
	4/15/93	20.9	0.5	0	−0.01	20.7	0.8	20	−0.02	20.0	1.4	140	−0.02
	4/22/93	20.9	0.5	0	0.00	20.7	0.8	20	−0.01	20.0	1.5	140	−0.01
	4/29/93	20.9	0.5		0.00	20.7	0.8		−0.02	20.0	1.5	160	−0.03
	5/6/93	20.9	0.5	10		20.7	0.7	30	−0.03	19.8	1.4	180	
	5/13/93	20.9	0.5	0	−0.01	20.8	0.7	20	−0.01	20.0	1.4	140	−0.02
	5/20/93	20.8	0.5	0	0.00	20.6	0.8	20	0.00	20.8	1.6	160	0.00
	9/21/93	20.8	0.6	10	0.00	20.3	0.9	30	0.00	19.2	2.0	380	0.00
	10/30/93	20.9	0.5	0		20.7	0.8	20		19.7	1.9	280	

		LEVEL A (G)				LEVEL B (B)				LEVEL C (Y)			
MPT	Date	% O2	% CO2	HC (ppm)	Pressure (in water)	% O2	% CO2	HC (ppm)	Pressure (in water)	% O2	% CO2	HC (ppm)	Pressure (in water)
BKG1	11/13/92	20.9	0.8	40		20.9	0.8	80		20.9	0.8	120	
	11/20/92	20.9	0.5	40		20.9	0.7	120		20.9	0.8	150	
	12/02/92	20.9	1.1	50		20.9	1.0	100		20.9	1.5	150	
	2/12/93	20.7	0.5	0	0.00	20.5	0.5	0	0.00	20.4	1.0	0	0.00
	2/19/93	20.9	0.8		0.00	20.7	0.9		0.00	20.5	1.1		0.00
	2/26/93	20.8	0.6		0.00	20.6	0.7		0.00	20.5	0.8		0.00
	3/4/93	20.8	0.6		0.00	20.6	0.7		0.00	20.4	0.8		0.00
	3/11/93	20.8	0.6		0.00	20.5	0.8		0.00	20.3	0.8		0.00
	3/25/93	20.9	0.6	0	0.00	20.7	0.8	0	0.00	20.6	0.8	0	0.00
	4/3/93	20.8	0.6	0	0.00	20.7	0.7	10	0.00	20.7	0.8	20	0.00
	4/8/93	20.8	0.5	0	0.00	20.5	0.8	20	0.00	20.8	0.8	20	0.00
	4/15/93	20.9	0.6	10	0.00	20.8	0.7	10	0.00	20.7	0.8	20	0.00
	4/22/93	20.8	0.6	10	0.00	20.7	0.8	10	0.00	20.7	0.8	10	0.00
	4/29/93	20.8	0.6	10	0.00	20.8	0.8	10	0.00	20.7	0.8	10	0.00
	5/6/93	20.7	0.6	0		20.5	0.8	0		20.6	0.8	0	
	5/13/93	20.8	0.6	20	0.00	20.8	0.8	20	0.00	20.8	0.8	20	0.00
	5/20/93	20.9	0.6	5	0.00	20.8	0.8	10	0.00	20.8	0.8	20	0.00
	9/21/93	20.8	0.7	10	0.00	20.2	0.9	20	0.00	20.3	0.9	20	0.00
	10/30/93	20.9	0.5	0		20.7	0.7	10		20.7	0.8	10	
BKG2	11/20/92									20.9	0.8	57	
	12/02/92									20.9	0.1	20	
	1/12/93									20.9	0.5		
	1/15/93									20.8	0.5		
	1/18/93									20.8	0.4		0.00
	1/20/93									20.5	0.4		0.01
	1/28/93									20.9	0.7		0.00
	2/4/93									20.4	0.4		0.00
	2/12/93									20.6	0.8		0.00
	2/19/93									20.8	0.8		0.00
	2/26/93									20.6	0.7		0.00
	3/4/93									20.5	0.8		0.00
	3/11/93									20.8	0.6		0.00
	3/25/93									20.6	0.7	10	0.00
	4/3/93									20.6	0.7	10	0.00
	4/8/93									20.7	0.7	0	0.00
	4/15/93									20.6	0.7	10	0.00
	4/22/93									20.6	0.7	0	0.00
	4/29/93									20.7	0.7	0	0.00
	5/6/93									20.5	0.7	0	
	5/13/93									20.7	0.7	0	0.01
	5/20/93									20.7	0.8	10	0.00
	9/21/93									20.4	0.9	20	0.00
	10/30/93									20.7	0.9	20	

APPENDIX G

NAS FALLON
SOIL ANALYTICAL DATA

Alpha Analytical, Inc.
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ANALYTICAL REPORT

Battelle
505 King Ave
Columbus Ohio 43201

Job#:
Phone: (614) 424-6122
Attn: Jeff Kittel

Sampled: 07/21/93 Received: 07/22/93 Analyzed: 07/28-29/93

Matrix: [X] Soil [ ] Water [ ] Waste

Analysis Requested: TPH - Total Petroleum Hydrocarbons-Purgeable Quantitated As Gasoline
BTXE - Benzene,Toluene,Xylenes,Ethylbenzene

Methodology: TPH - Modified 8015/DHS LUFT Manual
BTXE - EPA Method 624/8240

TPH/BTXE Results:

Client ID/ Lab ID	Parameter	Concentration	Detection Limit
7-21-BK-2-3' /BMI072293-01	TPH (Purgeable)	ND	10 mg/Kg
	Benzene	ND	20 ug/Kg
	Toluene	ND	20 ug/Kg
	Total Xylenes	ND	20 ug/Kg
	Ethylbenzene	ND	20 ug/Kg
7-21-BK-5-6' /BMI072293-02	TPH (Purgeable)	ND	10 mg/Kg
	Benzene	ND	20 ug/Kg
	Toluene	ND	20 ug/Kg
	Total Xylenes	ND	20 ug/Kg
	Ethylbenzene	ND	20 ug/Kg
7-21-BK-7-8' /BMI072293-03	TPH (Purgeable)	ND	10 mg/Kg
	Benzene	ND	20 ug/Kg
	Toluene	ND	20 ug/Kg
	Total Xylenes	ND	20 ug/Kg
	Ethylbenzene	ND	20 ug/Kg
7-21-TS-2-3' /BMI072293-04	TPH (Purgeable)	ND	10 mg/Kg
	Benzene	ND	20 ug/Kg
	Toluene	ND	20 ug/Kg
	Total Xylenes	ND	20 ug/Kg
	Ethylbenzene	ND	20 ug/Kg

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Continued:

Client ID/ Lab ID	Parameter	Concentration	Detection Limit
7-21-TS-5-6' /BMI072293-05	TPH (Purgeable)	ND	10 mg/Kg
	Benzene	ND	20 ug/Kg
	Toluene	ND	20 ug/Kg
	Total Xylenes	ND	20 ug/Kg
	Ethylbenzene	ND	20 ug/Kg
7-21-TS-9-10' /BMI072293-06	TPH (Purgeable)*	180	40 mg/Kg
	Benzene	ND	80 ug/Kg
	Toluene	ND	80 ug/Kg
	Total Xylenes	510	80 ug/Kg
	Ethylbenzene	ND	80 ug/Kg
7-21-FF-2-3' /BMI072293-07	TPH (Purgeable)	ND	10 mg/Kg
	Benzene	ND	20 ug/Kg
	Toluene	ND	20 ug/Kg
	Total Xylenes	ND	20 ug/Kg
	Ethylbenzene	ND	20 ug/Kg
7-21-FF-6-7.5' /BMI072293-08	TPH (Purgeable)**	17,000	100 mg/Kg
	Benzene	870	200 ug/Kg
	Toluene	990	200 ug/Kg
	Total Xylenes	53,000	200 ug/Kg
	Ethylbenzene	10,000	200 ug/Kg

* - Hydrocarbons in the range of: C9-C10 = 11%; C11 = 20%; C12 = 33%; C13 = 24%; C14 = 11%.

** - Hydrocarbons in the range of : C7 to C9 = 5%; C10 = 8%; C11 = 21%; C12 = 33%; C13 = 26%; C14 = 7%.

ND - Not Detected

Approved By: Roger L. Scholl Date: 8/3/93
Roger L. Scholl, Ph.D.
Laboratory Director

CHEMAX Laboratories, Inc.

Analytical and Environmental Chemists
EPA Lab ID #NV004

(702) 355-0202
FAX (702) 355-0817

LABORATORY REPORT

Report To: Alpha Analytical, Inc.

Lab Report No.: 10332

Parameter	Results			
	TS-5-6'	TS-9-10'	FF-2-3'	FF-6-7.5'
pH_{sp}	9.38	9.19	7.98	9.07
Alkalinity, mg/kg as $CaCO_3$	23,000	6,100	4,150	6,840
Nitrate Nitrogen, mg/kg	<8	<7	17	<7
TKN, mg/kg	113	49	89	87
Total Phosphorus, mg/kg	1,470	919	385	1,140
Chloride, mg/kg	1,380	662	1,950	1,960
Sulfate, mg/kg	1,600	986	1,870	2,110
Arsenic, mg/kg	28	9.9	13	11
Sodium, mg/kg	3,000	1,480	2,370	2,930
Calcium, mg/kg	18	9.9	35	4.1
Magnesium, mg/kg	1.3	1.2	12	3.9
Iron, mg/kg	23,530	14,290	23,170	25,000
Moisture, %	32	23	18	24

Remarks: Results have been corrected for moisture.

Analysis By: Fausltich/Joyce/Knudsen/Lettice/Nannini

Date: 08/06/93

Approved By: Colin A. Lettice

Date: 08/09/93

992 Spice Islands Drive, Sparks, Nevada 89431 • P.O. Box 21122, Reno, Nevada 89515

CHEMAX Laboratories, Inc.

Analytical and Environmental Chemists
EPA Lab ID #NV004

(702) 355-0202
FAX (702) 355-0817

LABORATORY REPORT

Report To: Alpha Analytical, Inc.
255 Glendale Avenue, Suite 21
Sparks, NV 89431

Lab Report No.: 10332
Account No.: ALPHA

Telephone: 355-1044

Fax: 355-0406

Work Authorized By: Randy Gardner
Date Sampled: 07/21/93
Number of Samples: 8
Source: See Below
Chemax Control No. 93-5016 thru 5023

Date Submitted: 07/22/93
Sampled By: Client
Your Reference: BMI072293

Parameter	Results			
	BK-2-3'	BK-5-6'	BK-7-8'	TS-2-3'
pH_{SP}	8.40	8.72	9.37	8.28
Alkalinity, mg/kg as $CaCO_3$	2,690	6,150	6,340	8,290
Nitrate Nitrogen, mg/kg	<7	<7	<7	<7
TKN, mg/kg	114	77	70	148
Total Phosphorus, mg/kg	1,160	882	720	1,260
Chloride, mg/kg	3,180	971	1,290	4,500
Sulfate, mg/kg	9,710	2,210	2,730	3,450
Arsenic, mg/kg	9.6	11	22	18
Sodium, mg/kg	7,910	1,920	2,650	4,930
Calcium, mg/kg	667	9.9	6.2	43
Magnesium, mg/kg	24	1.4	2.2	15
Iron, mg/kg	24,360	16,480	14,630	24,390
Moisture, %	22	9	18	18

Remarks: Results have been corrected for moisture.

Analysis By: Fausitich/Joyce/Knudsen/Lettice/Nannini

Date: 08/06/93

Approved By: Colin A. Lettice

Date: 08/09/93

992 Spice Islands Drive, Sparks, Nevada 89431 • P.O. Box 21122, Reno, Nevada 89515

Hazleton
Environmental
Services, Inc.

525 SCIENCE DRIVE • MADISON, WISCONSIN 53711

December 20, 1993

Jeff Kittle
Battelle Memorial Institute
505 King Avenue
Columbus, OH 43201-2693

Dear Mr. Kittle:

Enclosed please find the analytical reports for analysis on samples received November 5, 1993 from the NAS Fallon project. Included with the data are the original signed chain of custody sheets which accompanied the samples from the field to the laboratory.

Please note the following analytical issues as they pertained to the sample analyses:

Total Petroleum Hydrocarbons - Diesel Fraction

Samples TS1NOV2-2'-3', TS1NOV2-5'-6', TS2NOV2-3'-4', TS2NOV2-6'-7', BKNOV2-2'-3', BKNOV2-5'-6', BKNOV2-7'-8' and FFNOV2-2'-3' all contained a large singular peak just beyond the retention time window used to calculate the diesel concentration. This peak was not used in the calculation of diesel concentration. Raw sample chromatograms for these samples have been provided.

Sample TS1NOV2-3'-4' contained two well defined peaks, that when quantitated, the concentration was above upper calibration limit for the assay. Several unsuccessful attempts were made to dilute the sample to within calibration range. Results for this sample are taken from the original analysis which even though is above the calibration range is still within the linear range of the instrument.

Hazleton
Environmental
Services, Inc.

525 SCIENCE DRIVE • MADISON. WISCONSIN 53711

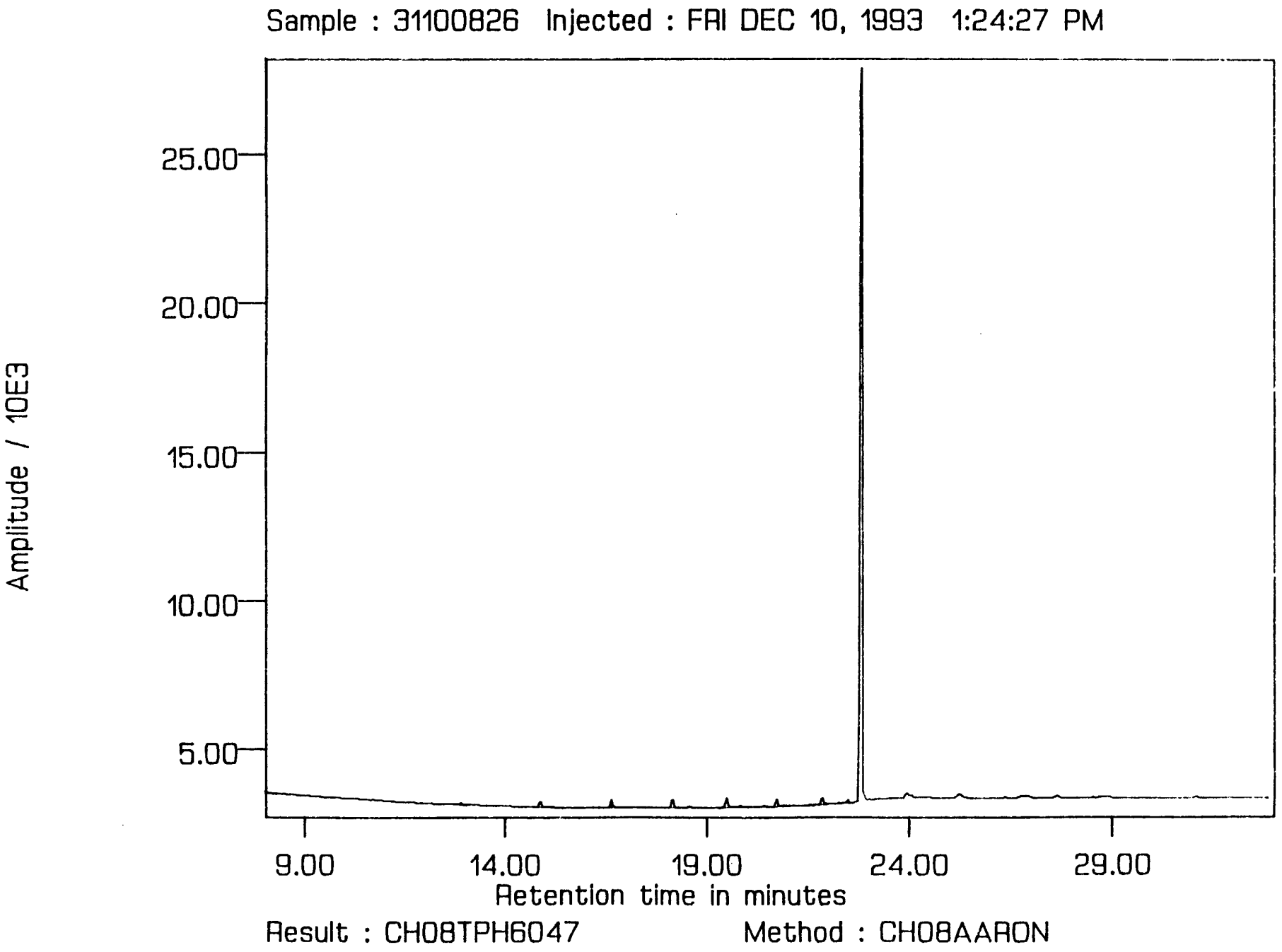
If you have any questions regarding this data please contact myself at (608)232-3305 or Dawn Wheeler at (608)232-3309.

Best Regards,

David O. Edwards
Account Executive

Dawn M Wheeler

Dawn Wheeler
Group Leader
General Organics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15.00
10.00
5.00
Amplitude / 10E3
9.00
14.00
19.00
24.00
29.00
Retention time in minutes
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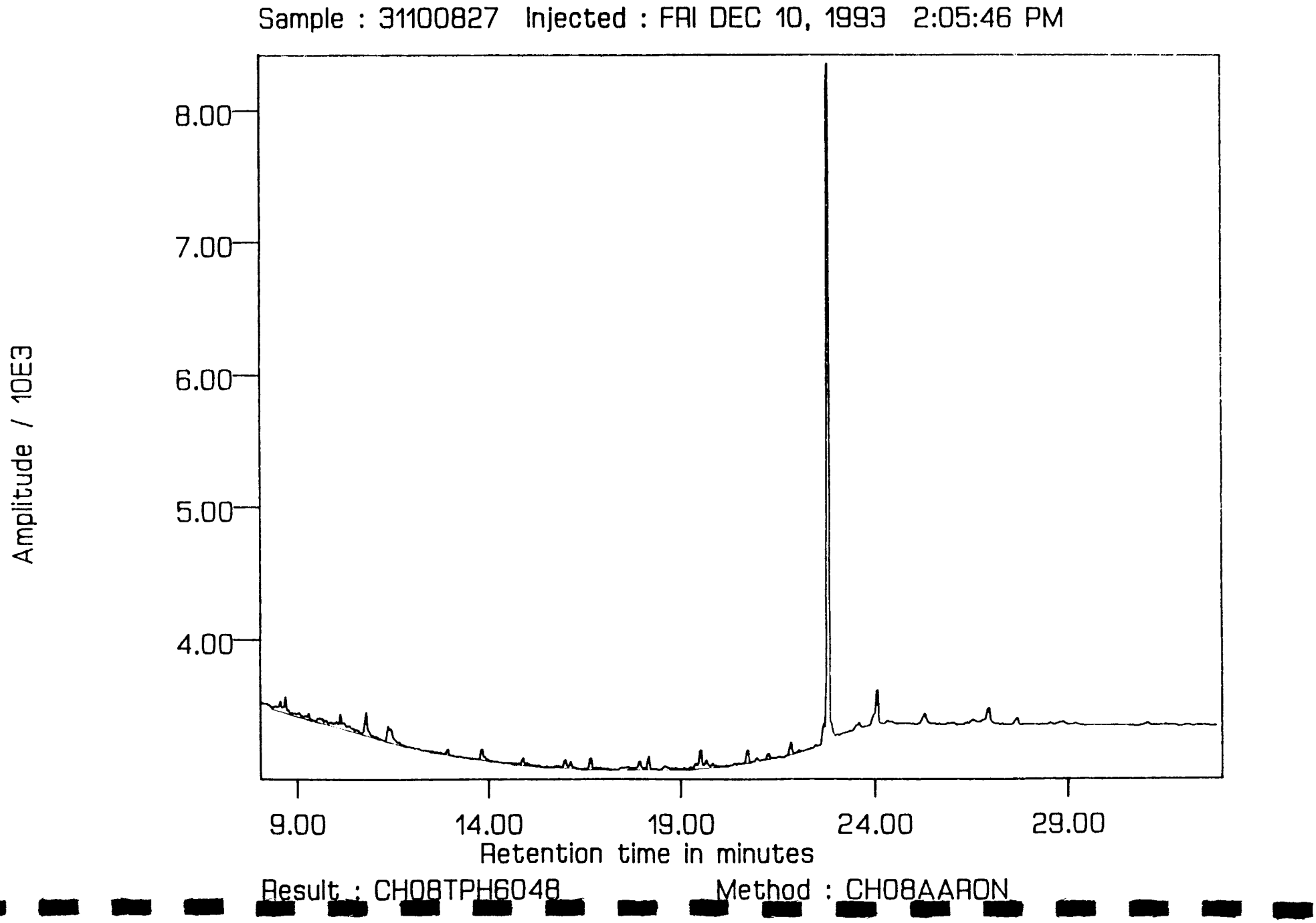
Method : CH08AARON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8.00
7.00
6.00
5.00
4.00
Amplitude / 10E3
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14.00
19.00
24.00
29.00
Retention time in minutes
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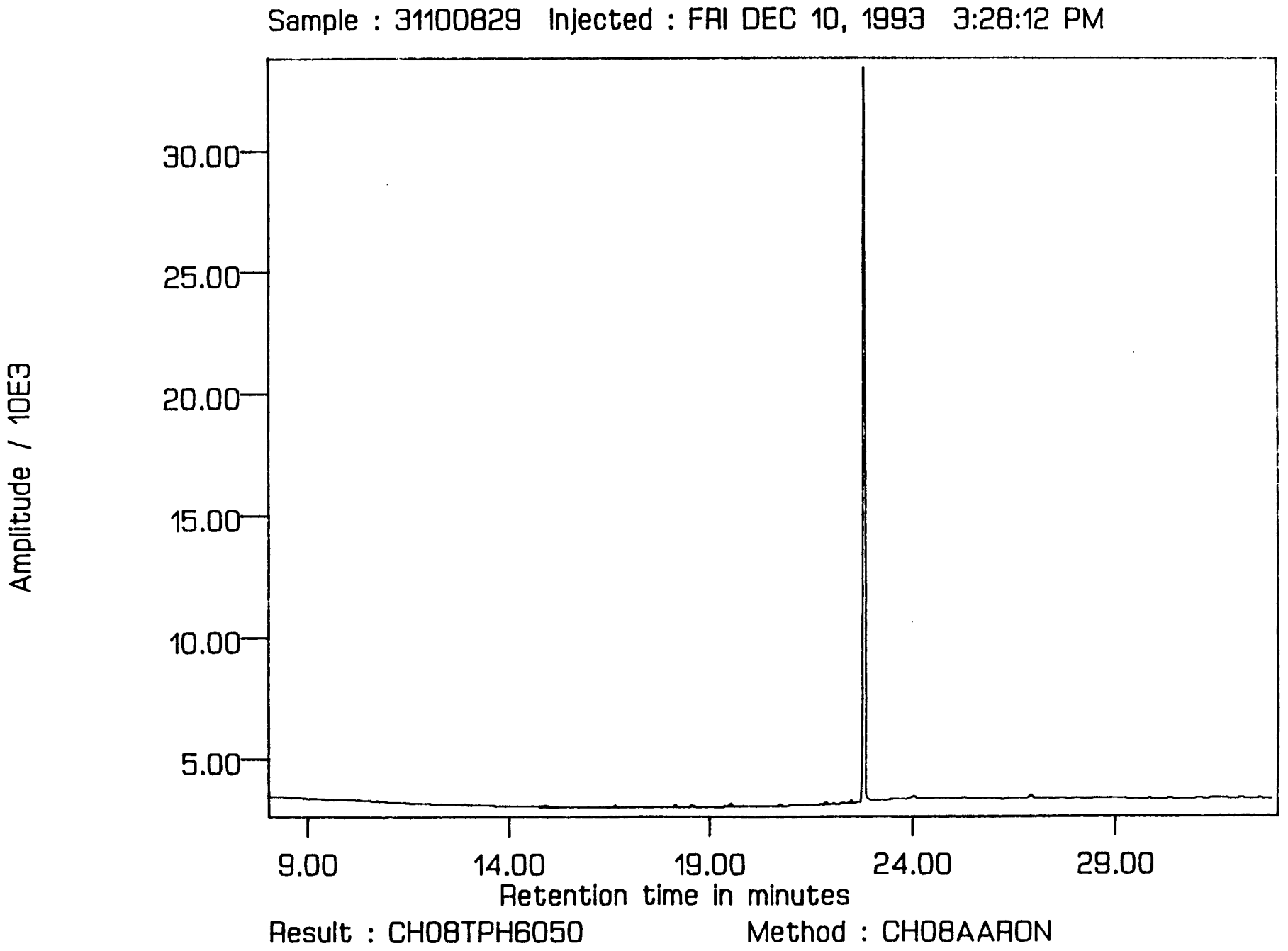
Method : CH08AARON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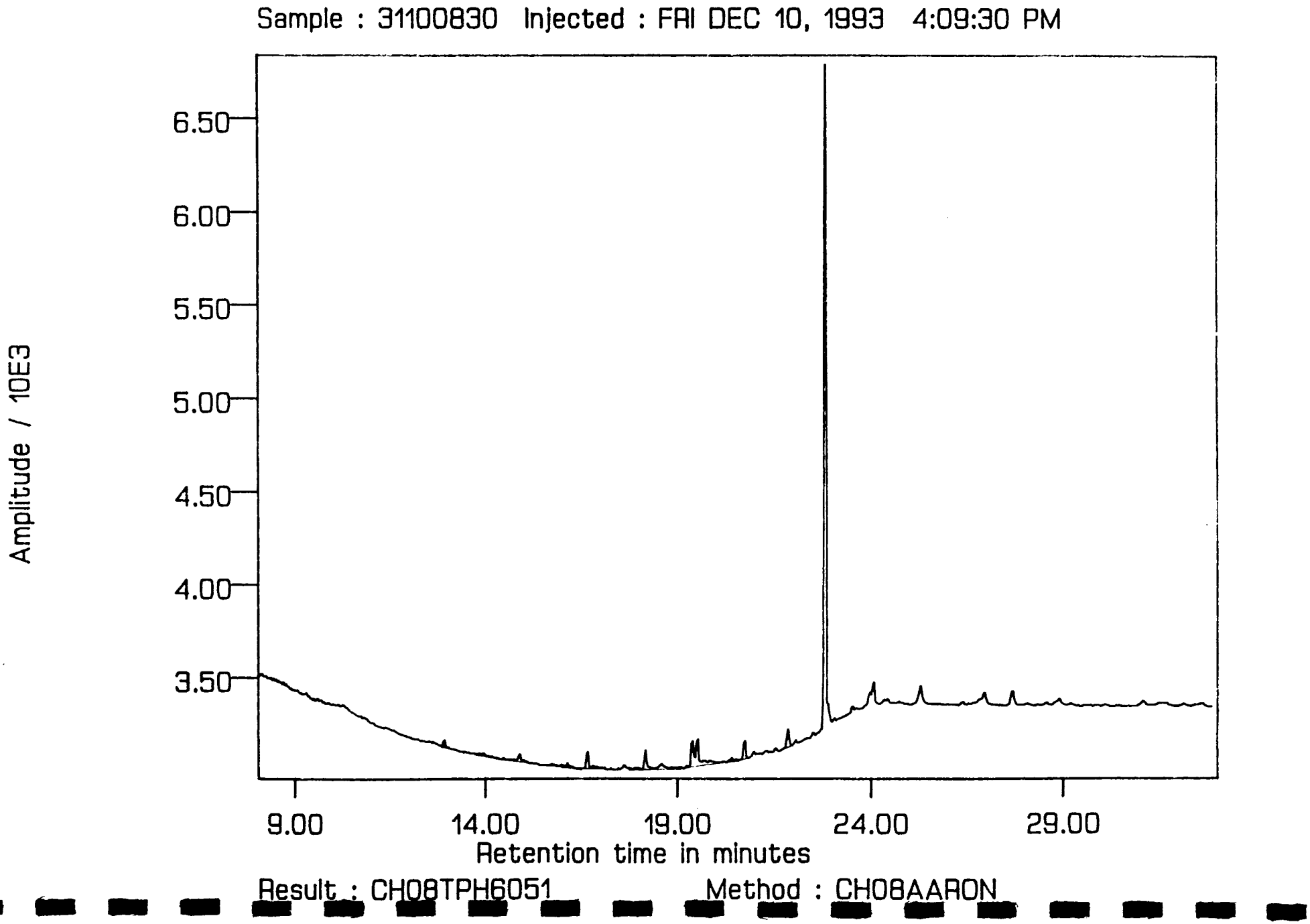
20.00
15.00
10.00
5.00
Amplitude / 10E3
9.00
14.00
19.00
24.00
29.00
Retention time in minutes
Result : CH08TPH6050
Method : CH08AARON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5.50
5.00
4.50
4.00
3.50
Amplitude / 10E3
9.00
14.00
19.00
24.00
29.00
Retention time in minutes
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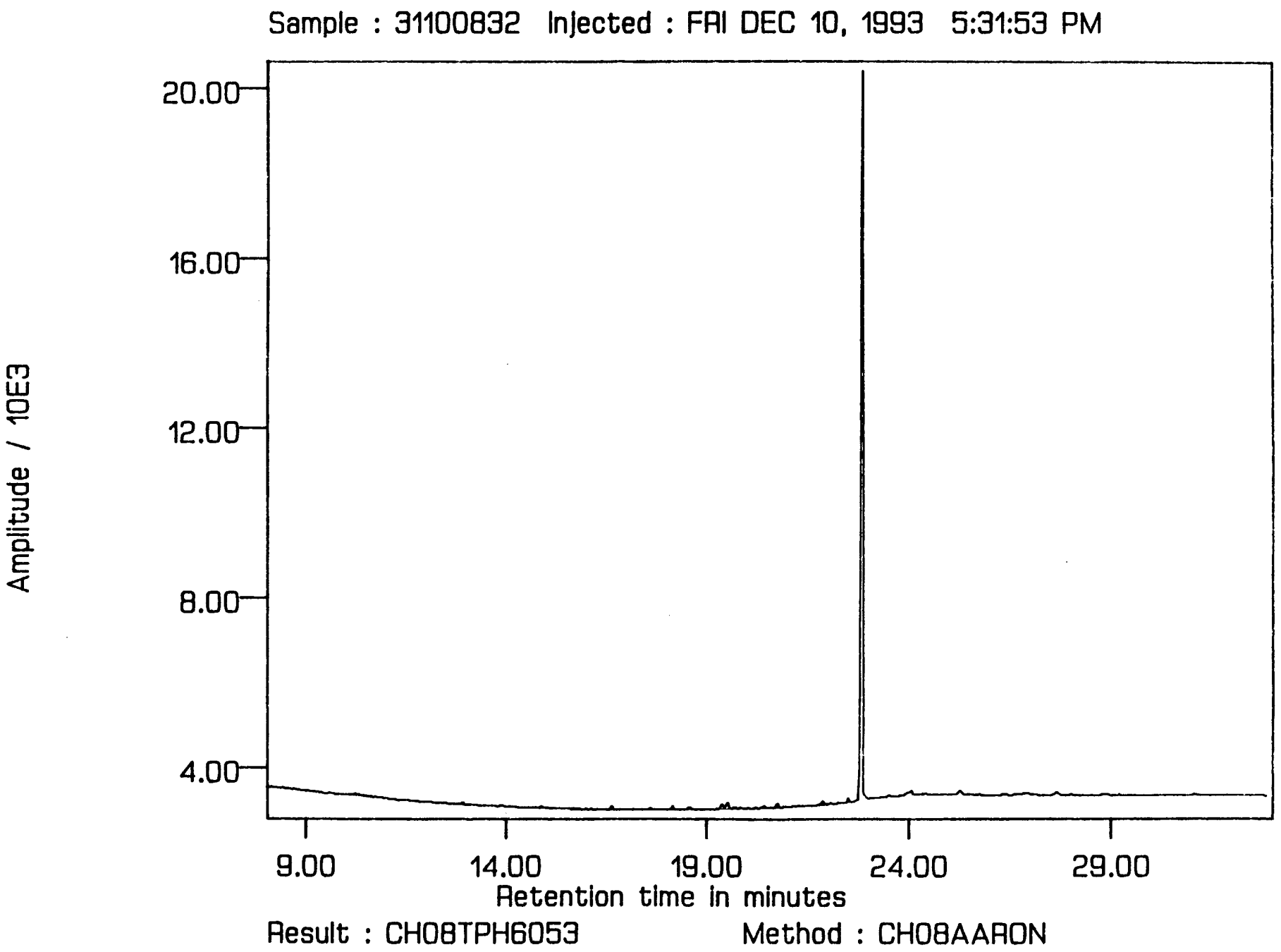
Method : CH08AARON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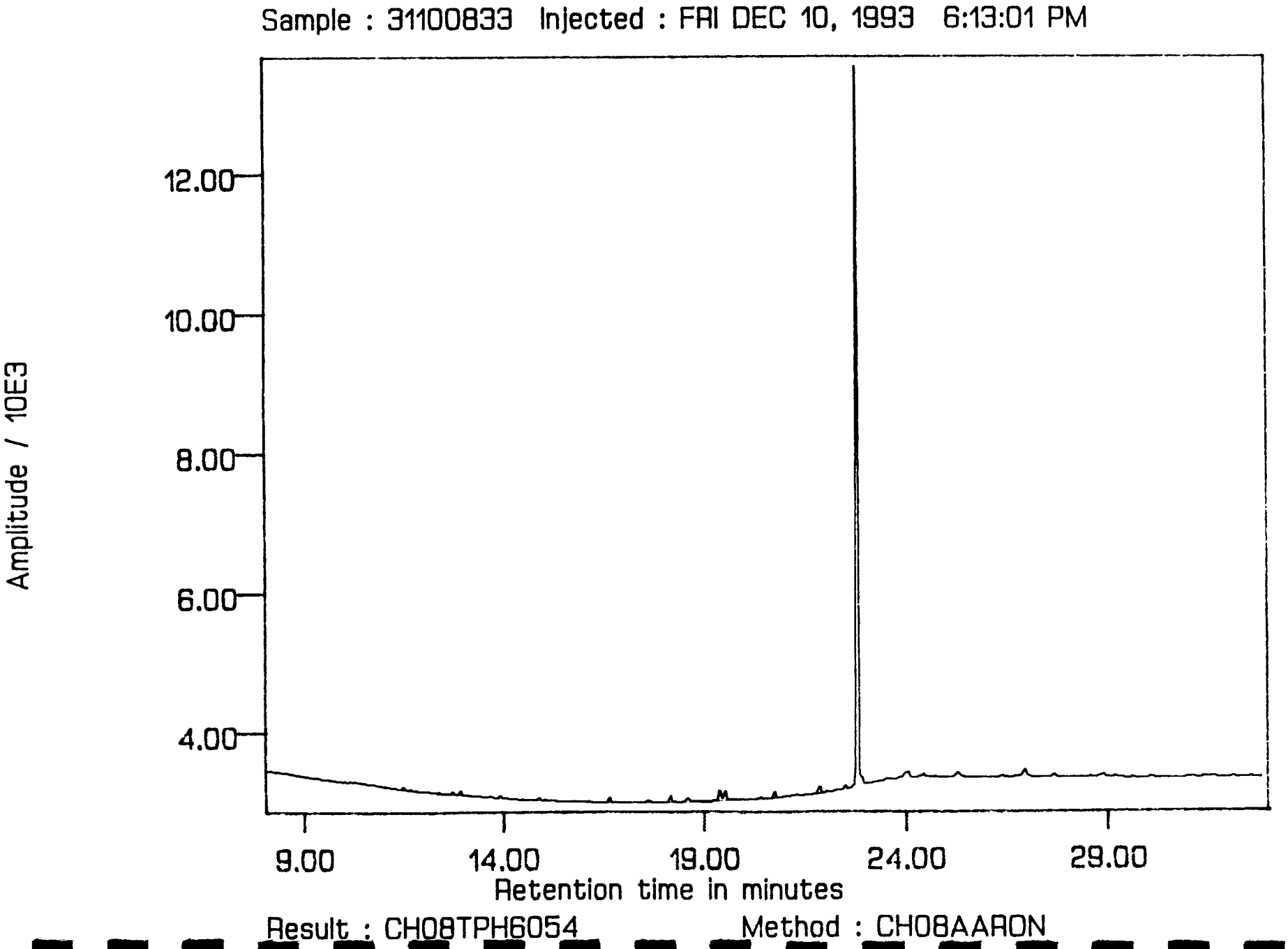
16.00
12.00
8.00
4.00
Amplitude / 10E3
9.00
14.00
19.00
24.00
29.00
Retention time in minutes
Result : CH08TPH6053
Method : CH08AARON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6.00
4.00
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14.00
19.00
24.00
29.00
Retention time in minutes
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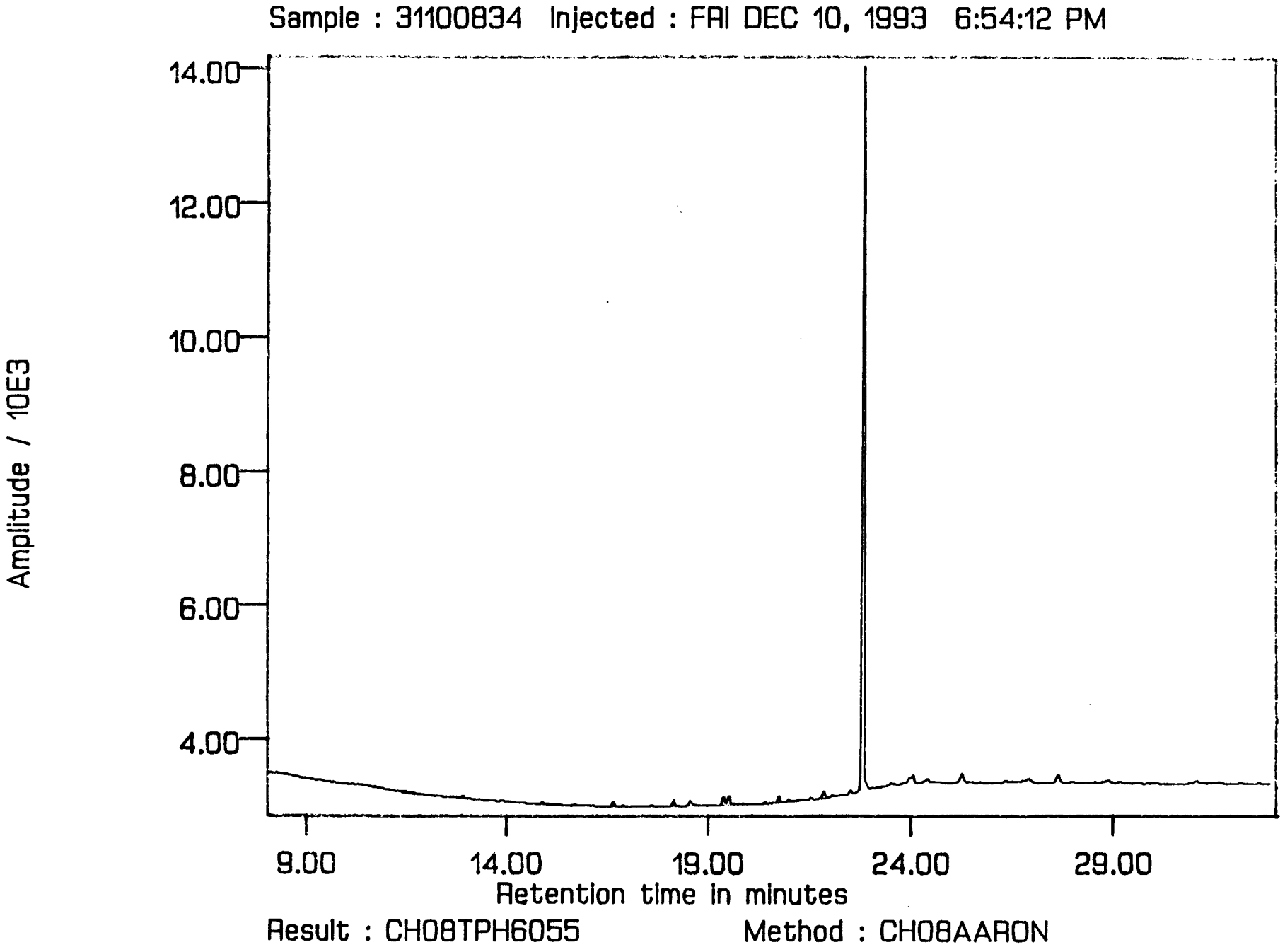
Method : CH08AARON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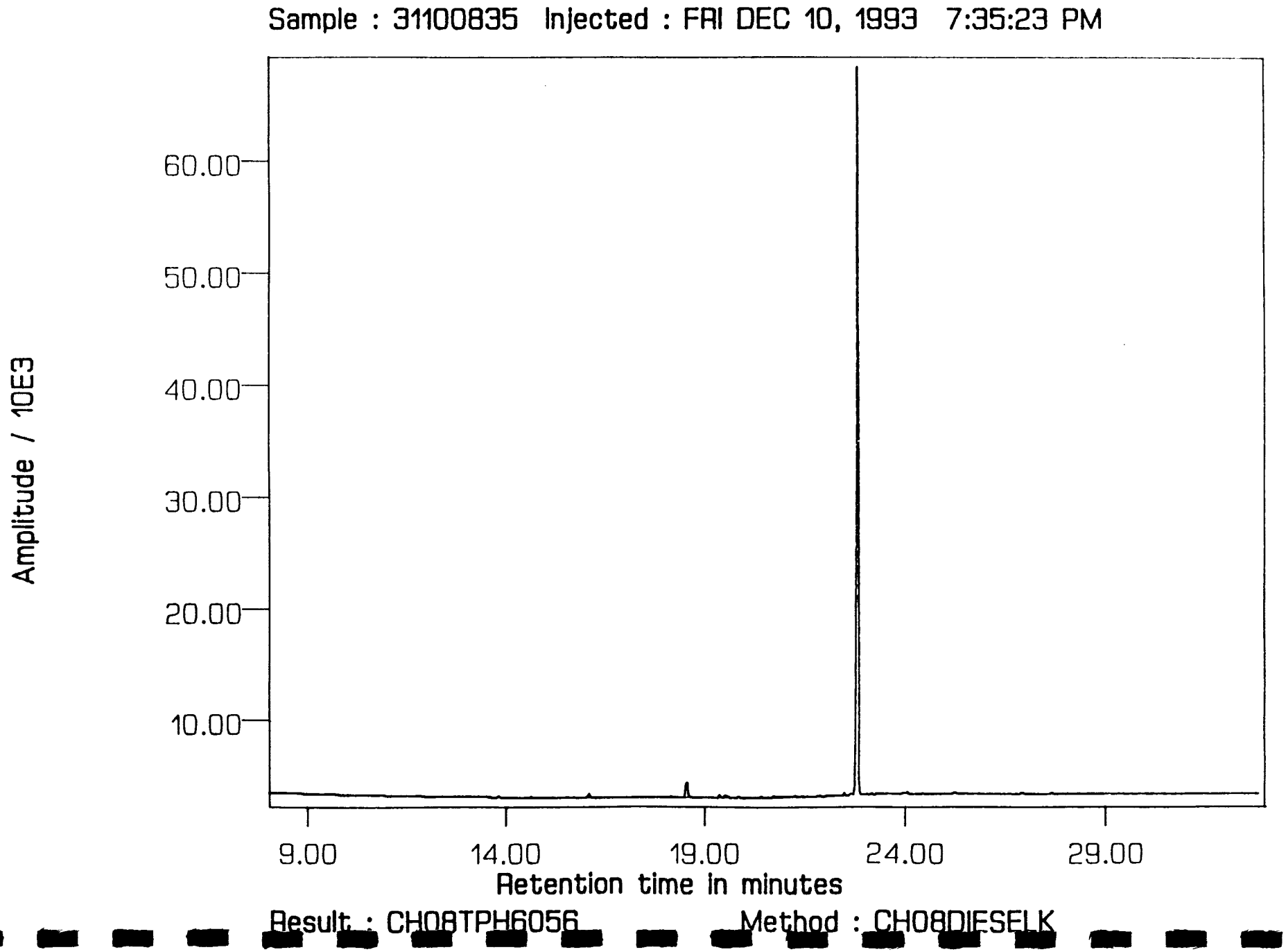
10.00
8.00
6.00
4.00
Amplitude / 10E3
9.00
14.00
19.00
24.00
29.00
Retention time in minutes
Result : CH08TPH6055
Method : CH08AARON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40.00
30.00
20.00
10.00
Amplitude / 10E3
9.00
14.00
19.00
24.00
29.00
Retention time in minutes
Result : CH08TPH6056
Method : CH08DIESELK

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2. The term "Less Than" or the symbol (<) is used to signify the lower limit of quantitation of the procedure under the conditions employed. The use of the term "Less Than" or (<) does not imply that traces of analyte were present.

   The term "None Detected" is used to report assay results where detection limits have been established for the method but acceptable residue levels have not been defined by the industry or by federal law or when the method does not define detection limits. The term will specify the fixed amount of sample employed in the analysis and does not imply that traces of the analyte were present.

3. Samples submitted to HES for routine analysis will be retained for a minimum of sixty (60) days after the report of analysis is issued. Extended storage requirements must be brought to the attention of HES prior to or at the time of sample submission. HES, at its discretion, may charge for such extended storage. Records and specimens from all government regulated studies will be maintained in accordance with federal regulations.

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6. Records of the raw data, reports, etc., will be maintained by HES in its data archives for a minimum of five (5) years unless otherwise specified by government regulations after the completion of the requested work. One (1) duplicate report will be made available free of charge for a period of one (1) year. HES reserves the right to charge for copies made after one (1) year and to charge for any and all copies of raw data requested.

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Hazleton
Environmental
Services, Inc.

REPORT OF ANALYSIS

BATTELLE MEMORIAL INSTITUTE
J. KITTEL
505 KING AVENUE
COLUMBUS, OH 43201-2693

SAMPLE NUMBER: 3110082
DATE ENTERED: 11/08/93
REPORT PRINTED: 12/20/93

SOIL: TS1NOV2-2'-3'; 11/2/93
PROJECT NAME: NAS FALLON

PURCHASE ORDER NUMBER: 66744

ASSAY	ANALYSIS	UNITS
ALKALINITY	680.	MG/KG
ARSENIC	20.1	PPM
LEAD	4.9	PPM
NITRATE-N	2.39	MG/KG
NITRITE-N	< .20	MG/KG

BTEX ANALYSIS IN SOILS

COMPOUND NAME	DILUTION FACTOR	DETECTION LIMIT	CONC UG/L
BENZENE	1	1.2	2.9
TOLUENE	1	1.2	5.8
ETHYLBENZENE	1	1.2	2.5
m AND p-XYLENE	1	2.5	< 2.5
o-XYLENE	1	1.2	< 1.2
FLUOROBENZENE (SURROGATE)	98	% RECOVERED	
DATE ANALYZED	11/15/93		
DATE RECEIVED	11/05/93		

TOTAL ORGANIC CARBON - SOILS)	1290.	PPM
TOTAL KJELDAHL NITROGEN-SOIL	520.	MG/KG
TOTAL PHOSPHORUS	.575	MG/KG

SAMPLE NUMBER: 31100826

SOIL: TS1NOV2-2'-3'; 11/2/93
PROJECT NAME: NAS FALLON

ASSAY	ANALYSIS	UNITS
PH IN SOILS	8.26	

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
PARTICAL SIZE		
SAND	63	%
SILT	20	%
CLAY	17	%

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
CATION EXCHANGE CAPACITY	24.34	MEQ/100G

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
EXCHANGEABLE AMMONIUM-NITROGEN	< 3	PPM

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
EXCHANGEABLE IRON	< 1	PPM

TOTAL PETROLEUM HYDROCARBONS/DIESEL

DIESEL	CONCENTRATION		DETECTION LIMIT	
DRY WEIGHT	< 10	MG/KG	10	MG/KG
CONTROL SPIKE	113	% RECOVERY		
DUPLICATE CONTROL SPIKE	107	% RECOVERY		
DILUTION FACTOR	1			
DATE RECEIVED	11/05/93			
DATE EXTRACTED	11/16/93			
DATE ANALYZED	12/10/93			
DRO STANDARD SOURCE	DIESEL FUEL SUPPLIED BY LOCAL STATION			

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS

TRPH CONCENTRATION	RESULTS		DETECTION LIMIT	
	< 10	MG/KG	10	MG/KG
CONTROL SPIKE	100	% RECOVERY		

SOIL: TS1NOV2-2'-3'; 11/2/93
PROJECT NAME: NAS FALLON

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (CONTINUED)

DUPLICATE CONTROL SPIKE	106 % RECOVERY
DATE RECEIVED	11/05/93
DATE EXTRACTED	11/09/93
DATE ANALYZED	11/17/93
TOTAL SOLIDS (%)	80
PH	8

METHOD REFERENCES

ALKALINITY
STANDARD METHODS FOR THE EXAMINATION OF WATERS AND WASTEWATER, 17TH EDITION, METHOD 2320B, APHA, AWWA, WPCF, WASHINGTON, D.C. (1989).

ARSENIC
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS (3030, 3040, OR 3050) AND 7060, U.S. EPA, WASHINGTON, D.C. (REVISED APRIL 1984).
CONTRACT LABORATORY PROGRAM STATEMENT OF WORK NO. 785, METHOD 206.2 CLP-M, U.S. EPA, WASHINGTON, D. C. (JULY 1985).

LEAD
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS (3030, 3040 OR 3050) AND 7421, U.S. EPA, WASHINGTON, DC (REVISED APRIL 1984)

NITRATE-N
OFFICIAL METHODS OF ANALYSIS, 15TH EDITION, METHOD 973.50, AOAC, ARLINGTON, VIRGINIA (1990).

NITRITE-N
STANDARD METHODS FOR EXAMINATION OF WATER & WASTEWATER, 5TH EDITION, METHOD 4500-NO2 APHA, AWWA, WPCF, WASHINGTON, D.C. (1989).

SOIL: TS1NOV2-2'-3'; 11/2/93
PROJECT NAME: NAS FALLON

METHOD REFERENCES (CONTINUED)

BTEX ANALYSIS IN SOILS
EPA SW-846 METHOD 8021: "VOLATILE ORGANIC COMPOUNDS IN WATER BY PURGE AND TRAP CAPILLARY COLUMN GAS CHROMATOGRAPHY WITH PHOTINIZATION AND ELECTROLYTIC CONDUCTIVITY DETECTORS IN SERIES."
REV 0, DECEMBER 1987
U.S. EPA METHOD 602 (FEDERAL REGISTER, VOLUME 49, NO. 209, PG. 43261-43271, OCTOBER 26, 1984).
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS, 8020, 5030, U.S. EPA, WASHINGTON, DC(REVISED APRIL, 1984).

TOTAL ORGANIC CARBON - SOILS)
DETERMINATION OF TOTAL ORGANIC CARBON IN SEDIMENT. LLOYD KAHN, USEPA, REGION II, EDISON, NJ 08837. 7/27/88

TOTAL KJELDAHL NITROGEN-SOIL
SUBCONTRACTED ANALYSIS; EPA 351.3; RMT,INC., MADISON, WI.

TOTAL PHOSPHORUS
EPA 600/4-79-020, METHOD 365.2

PH IN SOILS
TEST METHODS FOR EVALUATING SOLID WASTE. USEPA, SW-846, THIRD EDITION, NOVEMBER 1990, METHOD 9045.

SUBCONTRACTED ANALYSIS
SIEVE HYDROMETER PARTICLE SIZE TEST; UNIVERSITY OF WISCONSIN-EXTENSION SOIL AND PLANT ANALYSIS LABORATORY; MADISON, WI.

SUBCONTRACTED ANALYSIS
CATION EXCHANGE CAPACITY BY AMMONIUM SATURATION. METHOD IS A MODIFICATION OF THE METHOD DESCRIBED IN: "METHODS OF SOIL ANALYSIS," PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965, PP. 894-899. AMERICAN SOCIETY OF AGRONOMY.

SUBCONTRACTED ANALYSIS
"METHODS OF SOIL ANALYSIS, " PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965 PP 664-665. AMERICAN SOCIETY OF AGRONOMY. 1N KC1 (ACIDIFIED) EXTRACTION OF SOIL. MEASUREMENT BY ELECTRODE.

SUBCONTRACTED ANALYSIS
"METHODS OF SOIL ANALYSIS," PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965, PP 307-308. AMERICAN SOCIETY OF AGRONOMY. 1N AMMONIUM ACETATE EXTRACTION. DETERMINATION BY FLAME AA.

TOTAL PETROLEUM HYDROCARBONS/DIESEL
STATE OF CALIFORNIA LUFT METHOD

SOIL: TS1NOV2-2'-3'; 11/2/93
PROJECT NAME: NAS FALLON

METHOD REFERENCES (CONTINUED)

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS
WI DNR MODIFIED VERSION OF EPA DRAFT METHOD 9073.

Hazleton
Environmental
Services, Inc.

REPORT OF ANALYSIS

BATTELLE MEMORIAL INSTITUTE
J. KITTEL
505 KING AVENUE
COLUMBUS, OH 43201-2693

SAMPLE NUMBER: 31100827
DATE ENTERED: 11/08/93
REPORT PRINTED: 12/20/93

SOIL: TS1NOV2-5'-6'; 11/2/93
PROJECT NAME: NAS FALLON

PURCHASE ORDER NUMBER: 66744

ASSAY	ANALYSIS	UNITS
ALKALINITY	3350.	MG/KG
ARSENIC	32.5	PPM
LEAD	9.7	PPM
NITRATE-N	2.32	MG/KG
NITRITE-N	< .20	MG/KG

BTEX ANALYSIS IN SOILS

COMPOUND NAME	DILUTION FACTOR	DETECTION LIMIT	CONC UG/L
BENZENE	1	1.2	< 1.2
TOLUENE	1	1.2	3.8
ETHYLBENZENE	1	1.2	< 1.2
m AND p-XYLENE	1	2.3	< 2.3
o-XYLENE	1	1.2	< 1.2
FLUOROBENZENE (SURROGATE)	92	% RECOVERED	
DATE ANALYZED	11/15/93		
DATE RECEIVED	11/05/93		

TOTAL ORGANIC CARBON - SOILS)	577.	PPM
TOTAL KJELDAHL NITROGEN-SOIL	240.	MG/KG
TOTAL PHOSPHORUS	.788	MG/KG

SOIL: TS1NOV2-5'-6'; 11/2/93
PROJECT NAME: NAS FALLON

ASSAY	ANALYSIS	UNITS
PH IN SOILS	9.65	

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
PARTICAL SIZE		
SAND	51	%
SILT	30	%
CLAY	19	%

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
CATION EXCHANGE CAPACITY	17.82	MEQ/100G

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
EXCHANGEABLE AMMONIUM-NITROGEN	< 3	PPM

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
EXCHANGEABLE IRON	< 1	PPM

TOTAL PETROLEUM HYDROCARBONS/DIESEL

DIESEL	CONCENTRATION		DETECTION LIMIT	
DRY WEIGHT	< 10	MG/KG	10	MG/KG
CONTROL SPIKE	113	% RECOVERY		
DUPLICATE CONTROL SPIKE	107	% RECOVERY		
DILUTION FACTOR	1			
DATE RECEIVED	11/05/93			
DATE EXTRACTED	11/16/93			
DATE ANALYZED	12/10/93			
DRO STANDARD SOURCE	DIESEL FUEL SUPPLIED BY LOCAL STATION			

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS

TRPH CONCENTRATION	RESULTS	DETECTION LIMIT
	< 10 MG/KG	10 MG/KG
CONTROL SPIKE	100 % RECOVERY	

SOIL: TS1NOV2-5'-6'; 11/2/93
PROJECT NAME: NAS FALLON

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (CONTINUED)

DUPLICATE CONTROL SPIKE	106	% RECOVERY
DATE RECEIVED	11/05/93	
DATE EXTRACTED	11/09/93	
DATE ANALYZED	11/17/93	
TOTAL SOLIDS (%)	86	
PH	9	

METHOD REFERENCES

ALKALINITY
STANDARD METHODS FOR THE EXAMINATION OF WATERS AND WASTEWATER, 17TH EDITION, METHOD 2320B, APHA, AWWA, WPCF, WASHINGTON, D.C. (1989).

ARSENIC
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS (3030, 3040, OR 3050) AND 7060, U.S. EPA, WASHINGTON, D.C. (REVISED APRIL 1984).
CONTRACT LABORATORY PROGRAM STATEMENT OF WORK NO. 785, METHOD 206.2 CLP-M, U.S. EPA, WASHINGTON, D. C. (JULY 1985).

LEAD
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS (3030, 3040 OR 3050) AND 7421, U.S. EPA, WASHINGTON, DC (REVISED APRIL 1984)

NITRATE-N
OFFICIAL METHODS OF ANALYSIS, 15TH EDITION, METHOD 973.50, AOAC, ARLINGTON, VIRGINIA (1990).

NITRITE-N
STANDARD METHODS FOR EXAMINATION OF WATER & WASTEWATER, 5TH EDITION, METHOD 4500-NO2 APHA, AWWA, WPCF, WASHINGTON, D.C. (1989).

SOIL: TS1NOV2-5'-6'; 11/2/93
PROJECT NAME: NAS FALLON

METHOD REFERENCES (CONTINUED)

BTEX ANALYSIS IN SOILS
EPA SW-846 METHOD 8021: "VOLATILE ORGANIC COMPOUNDS IN WATER BY PURGE AND TRAP CAPILLARY COLUMN GAS CHROMATOGRAPHY WITH PHOTINIZATION AND ELECTROLYTIC CONDUCTIVITY DETECTORS IN SERIES."
REV 0, DECEMBER 1987
U.S. EPA METHOD 602 (FEDERAL REGISTER, VOLUME 49, NO. 209, PG. 43261-43271, OCTOBER 26, 1984).
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS, 8020, 5030, U.S. EPA, WASHINGTON, DC(REVISED APRIL, 1984).

TOTAL ORGANIC CARBON - SOILS)
DETERMINATION OF TOTAL ORGANIC CARBON IN SEDIMENT. LLOYD KAHN, USEPA, REGION II, EDISON, NJ 08837. 7/27/88

TOTAL KJELDAHL NITROGEN-SOIL
SUBCONTRACTED ANALYSIS; EPA 351.3; RMT,INC., MADISON, WI.

TOTAL PHOSPHORUS
EPA 600/4-79-020, METHOD 365.2

PH IN SOILS
TEST METHODS FOR EVALUATING SOLID WASTE. USEPA, SW-846, THIRD EDITION, NOVEMBER 1990, METHOD 9045.

SUBCONTRACTED ANALYSIS
SIEVE HYDROMETER PARTICLE SIZE TEST; UNIVERSITY OF WISCONSIN-EXTENSION SOIL AND PLANT ANALYSIS LABORATORY; MADISON, WI.

SUBCONTRACTED ANALYSIS
CATION EXCHANGE CAPACITY BY AMMONIUM SATURATION. METHOD IS A MODIFICATION OF THE METHOD DESCRIBED IN: "METHODS OF SOIL ANALYSIS," PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965, PP. 894-899. AMERICAN SOCIETY OF AGRONOMY.

SUBCONTRACTED ANALYSIS
"METHODS OF SOIL ANALYSIS, " PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965 PP 664-665. AMERICAN SOCIETY OF AGRONOMY. 1N KC1 (ACIDIFIED) EXTRACTION OF SOIL. MEASUREMENT BY ELECTRODE.

SUBCONTRACTED ANALYSIS
"METHODS OF SOIL ANALYSIS," PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965, PP 307-308. AMERICAN SOCIETY OF AGRONOMY. 1N AMMONIUM ACETATE EXTRACTION. DETERMINATION BY FLAME AA.

TOTAL PETROLEUM HYDROCARBONS/DIESEL
STATE OF CALIFORNIA LUFT METHOD

Hazleton Environmental Services, Inc.

SAMPLE NUMBER: 31100827

SOIL: TS1NOV2-5'-6'; 11/2/93
PROJECT NAME: NAS FALLON

METHOD REFERENCES (CONTINUED)

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS
WI DNR MODIFIED VERSION OF EPA DRAFT METHOD 9073.

Hazleton Environmental Services, Inc.

REPORT OF ANALYSIS

BATTELLE MEMORIAL INSTITUTE
J. KITTEL
505 KING AVENUE
COLUMBUS, OH 43201-2693

SAMPLE NUMBER: 3110082
DATE ENTERED: 11/08/93
REPORT PRINTED: 12/20/93

SOIL: TS1NOV2-8'-9'; 11/2/93
PROJECT NAME: NAS FALLON

PURCHASE ORDER NUMBER: 66744

ASSAY	ANALYSIS	UNITS
ALKALINITY	2730.	MG/KG
ARSENIC	19.7	PPM
LEAD	8.1	PPM
NITRATE-N	1.79	MG/KG
NITRITE-N	< .20	MG/KG

BTEX ANALYSIS IN SOILS

COMPOUND NAME	DILUTION FACTOR	DETECTION LIMIT	CONC UG/L
BENZENE	500	620	< 620
TOLUENE	500	620	690
ETHYLBENZENE	500	620	770
m AND p-XYLENE	500	1200	1300
o-XYLENE	500	620	3500
FLUOROBENZENE (SURROGATE)	101	% RECOVERED	
DATE ANALYZED	11/16/93		
DATE RECEIVED	11/05/93		

TOTAL ORGANIC CARBON - SOILS)	609.	PPM
TOTAL KJELDAHL NITROGEN-SOIL	280.	MG/KG
TOTAL PHOSPHORUS	1.33	MG/KG

SAMPLE NUMBER: 31100828

SOIL: TS1NOV2-8'-9'; 11/2/93
PROJECT NAME: NAS FALLON

ASSAY	ANALYSIS	UNITS
PH IN SOILS	9.39	

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
PARTICAL SIZE		
SAND	41	%
SILT	38	%
CLAY	21	%

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
CATION EXCHANGE CAPACITY	19.01	MEQ/100G

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
EXCHANGEABLE AMMONIUM-NITROGEN	< 3	PPM

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
EXCHANGEABLE IRON	< 1	PPM

TOTAL PETROLEUM HYDROCARBONS/DIESEL

DIESEL	CONCENTRATION		DETECTION LIMIT	
DRY WEIGHT	8800	MG/KG	4000	MG/KG
CONTROL SPIKE	113	% RECOVERY		
DUPLICATE CONTROL SPIKE	107	% RECOVERY		
DILUTION FACTOR	400			
DATE RECEIVED	11/05/93			
DATE EXTRACTED	11/16/93			
DATE ANALYZED	12/10/93			
DRO STANDARD SOURCE	DIESEL FUEL SUPPLIED BY LOCAL STATION			

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS

TRPH CONCENTRATION	RESULTS		DETECTION LIMIT	
	4400	MG/KG	20	MG/KG
CONTROL SPIKE	100	% RECOVERY		

SOIL: TS1NOV2-8'-9'; 11/2/93
PROJECT NAME: NAS FALLON

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (CONTINUED)

DUPLICATE CONTROL SPIKE	106 % RECOVERY
DATE RECEIVED	11/05/93
DATE EXTRACTED	11/09/93
DATE ANALYZED	11/17/93
TOTAL SOLIDS (%)	80
PH	9

METHOD REFERENCES

ALKALINITY
STANDARD METHODS FOR THE EXAMINATION OF WATERS AND WASTEWATER, 17TH EDITION, METHOD 2320B, APHA, AWWA, WPCF, WASHINGTON, D.C. (1989).

ARSENIC
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS (3030, 3040, OR 3050) AND 7060, U.S. EPA, WASHINGTON, D.C. (REVISED APRIL 1984).
CONTRACT LABORATORY PROGRAM STATEMENT OF WORK NO. 785, METHOD 206.2 CLP-M, U.S. EPA, WASHINGTON, D. C. (JULY 1985).

LEAD
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS (3030, 3040 OR 3050) AND 7421, U.S. EPA, WASHINGTON, DC (REVISED APRIL 1984)

NITRATE-N
OFFICIAL METHODS OF ANALYSIS, 15TH EDITION, METHOD 973.50, AOAC, ARLINGTON, VIRGINIA (1990).

NITRITE-N
STANDARD METHODS FOR EXAMINATION OF WATER & WASTEWATER, 5TH EDITION, METHOD 4500-NO2 APHA, AWWA, WPCF, WASHINGTON, D.C. (1989).

SOIL: TS1NOV2-8'-9'; 11/2/93
PROJECT NAME: NAS FALLON

METHOD REFERENCES (CONTINUED)

BTEX ANALYSIS IN SOILS
EPA SW-846 METHOD 8021: "VOLATILE ORGANIC COMPOUNDS IN WATER BY PURGE AND TRAP CAPILLARY COLUMN GAS CHROMATOGRAPHY WITH PHOTINIZATION AND ELECTROLYTIC CONDUCTIVITY DETECTORS IN SERIES."
REV O, DECEMBER 1987
U.S. EPA METHOD 602 (FEDERAL REGISTER, VOLUME 49, NO. 209, PG. 43261-43271, OCTOBER 26, 1984).
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS, 8020, 5030, U.S. EPA, WASHINGTON, DC(REVISED APRIL, 1984).

TOTAL ORGANIC CARBON - SOILS)
DETERMINATION OF TOTAL ORGANIC CARBON IN SEDIMENT. LLOYD KAHN, USEPA, REGION II, EDISON, NJ 08837. 7/27/88

TOTAL KJELDAHL NITROGEN-SOIL
SUBCONTRACTED ANALYSIS; EPA 351.3; RMT,INC., MADISON, WI.

TOTAL PHOSPHORUS
EPA 600/4-79-020, METHOD 365.2

PH IN SOILS
TEST METHODS FOR EVALUATING SOLID WASTE. USEPA, SW-846, THIRD EDITION, NOVEMBER 1990, METHOD 9045.

SUBCONTRACTED ANALYSIS
SIEVE HYDROMETER PARTICLE SIZE TEST; UNIVERSITY OF WISCONSIN-EXTENSION SOIL AND PLANT ANALYSIS LABORATORY; MADISON, WI.

SUBCONTRACTED ANALYSIS
CATION EXCHANGE CAPACITY BY AMMONIUM SATURATION. METHOD IS A MODIFICATION OF THE METHOD DESCRIBED IN: "METHODS OF SOIL ANALYSIS," PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965, PP. 894-899. AMERICAN SOCIETY OF AGRONOMY.

SUBCONTRACTED ANALYSIS
"METHODS OF SOIL ANALYSIS, " PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965 PP 664-665. AMERICAN SOCIETY OF AGRONOMY. 1N KC1 (ACIDIFIED) EXTRACTION OF SOIL. MEASUREMENT BY ELECTRODE.

SUBCONTRACTED ANALYSIS
"METHODS OF SOIL ANALYSIS," PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965, PP 307-308. AMERICAN SOCIETY OF AGRONOMY. 1N AMMONIUM ACETATE EXTRACTION. DETERMINATION BY FLAME AA.

TOTAL PETROLEUM HYDROCARBONS/DIESEL
STATE OF CALIFORNIA LUFT METHOD

SOIL: TS1NOV2-8'-9'; 11/2/93
PROJECT NAME: NAS FALLON

METHOD REFERENCES (CONTINUED)

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS
WI DNR MODIFIED VERSION OF EPA DRAFT METHOD 9073.

Hazleton Environmental Services, Inc.

REPORT OF ANALYSIS

BATTELLE MEMORIAL INSTITUTE
J. KITTEL
505 KING AVENUE
COLUMBUS, OH 43201-2693

SAMPLE NUMBER: 31100829
DATE ENTERED: 11/08/93
REPORT PRINTED: 12/20/93

SOIL: TS2NOV2-3'-4'; 11/2/93
PROJECT NAME: NAS FALLON

PURCHASE ORDER NUMBER: 66744

ASSAY	ANALYSIS	UNITS
ALKALINITY	547.	MG/KG
ARSENIC	2.9	PPM
LEAD	4.3	PPM
NITRATE-N	< 1.06	MG/KG
NITRITE-N	< .20	MG/KG

BTEX ANALYSIS IN SOILS

COMPOUND NAME	DILUTION FACTOR	DETECTION LIMIT	CONC UG/L
BENZENE	1	1.1	< 1.1
TOLUENE	1	1.1	9.1
ETHYLBENZENE	1	1.1	< 1.1
m AND p-XYLENE	1	2.2	< 2.2
o-XYLENE	1	1.1	< 1.1
FLUOROBENZENE (SURROGATE)	88		
DATE ANALYZED	11/15/93		
DATE RECEIVED	11/05/93		

TOTAL ORGANIC CARBON - SOILS)	494.	PPM
TOTAL KJELDAHL NITROGEN-SOIL	120.	MG/KG
TOTAL PHOSPHORUS	.580	MG/KG

525 SCIENCE DRIVE • MADISON, WISCONSIN 53711 Phone 608-232-3300 Fax 608-233-0502

SAMPLE NUMBER: 31100829

SOIL: TS2NOV2-3'-4'; 11/2/93
PROJECT NAME: NAS FALLON

ASSAY	ANALYSIS	UNITS
PH IN SOILS	8.64	

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
PARTICAL SIZE		
SAND	75	%
SILT	12	%
CLAY	13	%

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
CATION EXCHANGE CAPACITY	9.40	MEQ/100G

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
EXCHANGEABLE AMMONIUM-NITROGEN	< 3	PPM

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
EXCHANGEABLE IRON	< 1	PPM

TOTAL PETROLEUM HYDROCARBONS/DIESEL

DIESEL	CONCENTRATION		DETECTION LIMIT	
DRY WEIGHT	< 10	MG/KG	10	MG/KG
CONTROL SPIKE	113	% RECOVERY		
DUPLICATE CONTROL SPIKE	107	% RECOVERY		
DILUTION FACTOR	1			
DATE RECEIVED	11/05/93			
DATE EXTRACTED	11/16/93			
DATE ANALYZED	12/10/93			
DRO STANDARD SOURCE	DIESEL FUEL SUPPLIED BY LOCAL STATION			

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS

TRPH CONCENTRATION	RESULTS		DETECTION LIMIT	
	70	MG/KG	10	MG/KG
CONTROL SPIKE	100	% RECOVERY		

SOIL: TS2NOV2-3'-4'; 11/2/93
PROJECT NAME: NAS FALLON

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (CONTINUED)

DUPLICATE CONTROL SPIKE	106	% RECOVERY
DATE RECEIVED	11/05/93	
DATE EXTRACTED	11/09/93	
DATE ANALYZED	11/17/93	
TOTAL SOLIDS (%)	91	
PH	8	

METHOD REFERENCES

ALKALINITY
STANDARD METHODS FOR THE EXAMINATION OF WATERS AND WASTEWATER, 17TH EDITION, METHOD 2320B, APHA, AWWA, WPCF, WASHINGTON, D.C. (1989).

ARSENIC
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS (3030, 3040, OR 3050) AND 7060, U.S. EPA, WASHINGTON, D.C. (REVISED APRIL 1984).
CONTRACT LABORATORY PROGRAM STATEMENT OF WORK NO. 785, METHOD 206.2 CLP-M, U.S. EPA, WASHINGTON, D. C. (JULY 1985).

LEAD
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS (3030, 3040 OR 3050) AND 7421, U.S. EPA, WASHINGTON, DC (REVISED APRIL 1984)

NITRATE-N
OFFICIAL METHODS OF ANALYSIS, 15TH EDITION, METHOD 973.50, AOAC, ARLINGTON, VIRGINIA (1990).

NITRITE-N
STANDARD METHODS FOR EXAMINATION OF WATER & WASTEWATER, 5TH EDITION, METHOD 4500-NO2 APHA, AWWA, WPCF, WASHINGTON, D.C. (1989).

SOIL: TS2NOV2-3'-4'; 11/2/93
PROJECT NAME: NAS FALLON

METHOD REFERENCES (CONTINUED)

BTEX ANALYSIS IN SOILS
EPA SW-846 METHOD 8021: "VOLATILE ORGANIC COMPOUNDS IN WATER BY PURGE AND TRAP CAPILLARY COLUMN GAS CHROMATOGRAPHY WITH PHOTINIZATION AND ELECTROLYTIC CONDUCTIVITY DETECTORS IN SERIES."
REV 0, DECEMBER 1987
U.S. EPA METHOD 602 (FEDERAL REGISTER, VOLUME 49, NO. 209, PG. 43261-43271, OCTOBER 26, 1984).
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS, 8020, 5030, U.S. EPA, WASHINGTON, DC(REVISED APRIL, 1984).

TOTAL ORGANIC CARBON - SOILS)
DETERMINATION OF TOTAL ORGANIC CARBON IN SEDIMENT. LLOYD KAHN, USEPA, REGION II, EDISON, NJ 08837. 7/27/88

TOTAL KJELDAHL NITROGEN-SOIL
SUBCONTRACTED ANALYSIS; EPA 351.3; RMT,INC., MADISON, WI.

TOTAL PHOSPHORUS
EPA 600/4-79-020, METHOD 365.2

PH IN SOILS
TEST METHODS FOR EVALUATING SOLID WASTE. USEPA, SW-846, THIRD EDITION, NOVEMBER 1990, METHOD 9045.

SUBCONTRACTED ANALYSIS
"METHODS OF SOIL ANALYSIS," PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965, PP 307-308. AMERICAN SOCIETY OF AGRONOMY. 1N AMMONIUM ACETATE EXTRACTION. DETERMINATION BY FLAME AA.

SUBCONTRACTED ANALYSIS
CATION EXCHANGE CAPACITY BY AMMONIUM SATURATION. METHOD IS A MODIFICATION OF THE METHOD DESCRIBED IN: "METHODS OF SOIL ANALYSIS," PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965, PP. 894-899. AMERICAN SOCIETY OF AGRONOMY.

SUBCONTRACTED ANALYSIS
"METHODS OF SOIL ANALYSIS, " PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965 PP 664-665. AMERICAN SOCIETY OF AGRONOMY. 1N KC1 (ACIDIFIED) EXTRACTION OF SOIL. MEASUREMENT BY ELECTRODE.

TOTAL PETROLEUM HYDROCARBONS/DIESEL
STATE OF CALIFORNIA LUFT METHOD

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS
WI DNR MODIFIED VERSION OF EPA DRAFT METHOD 9073.

Hazleton Environmental Services, Inc.

REPORT OF ANALYSIS

BATTELLE MEMORIAL INSTITUTE
J. KITTEL
505 KING AVENUE
COLUMBUS, OH 43201-2693

SAMPLE NUMBER: 31100830
DATE ENTERED: 11/08/93
REPORT PRINTED: 12/20/93

SOIL: TS2NOV2-6'-7'; 11/2/93
PROJECT NAME: NAS FALLON

PURCHASE ORDER NUMBER: 66744

ASSAY	ANALYSIS	UNITS
ALKALINITY	656.	MG/KG
ARSENIC	21.2	PPM
LEAD	10.4	PPM
NITRATE-N	1.51	MG/KG
NITRITE-N	< .20	MG/KG

BTEX ANALYSIS IN SOILS

COMPOUND NAME	DILUTION FACTOR	DETECTION LIMIT	CONC UG/L
BENZENE	1	1.3	< 1.3
TOLUENE	1	1.3	11
ETHYLBENZENE	1	1.3	< 1.3
m AND p-XYLENE	1	2.6	< 2.6
o-XYLENE	1	1.3	< 1.3
FLUOROBENZENE (SURROGATE)	90		
DATE ANALYZED	11/15/93		
DATE RECEIVED	11/05/93		

TOTAL ORGANIC CARBON - SOILS)	946.	PPM
TOTAL KJELDAHL NITROGEN-SOIL	160.	MG/KG
TOTAL PHOSPHORUS	.717	MG/KG

SAMPLE NUMBER: 31100830

SOIL: TS2NOV2-6'-7'; 11/2/93
PROJECT NAME: NAS FALLON

ASSAY	ANALYSIS	UNITS
PH IN SOILS	8.34	

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
PARTICAL SIZE		
SAND	35	%
SILT	40	%
CLAY	25	%

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
CATION EXCHANGE CAPACITY	23.33	MEQ/100G

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
EXCHANGEABLE AMMONIUM-NITROGEN	< 3	PPM

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
EXCHANGEABLE IRON	< 1	PPM

TOTAL PETROLEUM HYDROCARBONS/DIESEL

DIESEL	CONCENTRATION		DETECTION LIMIT	
DRY WEIGHT	< 10	MG/KG	10	MG/KG
CONTROL SPIKE	113	% RECOVERY		
DUPLICATE CONTROL SPIKE	107	% RECOVERY		
DILUTION FACTOR	1			
DATE RECEIVED	11/05/93			
DATE EXTRACTED	11/16/93			
DATE ANALYZED	12/10/93			
DRO STANDARD SOURCE	DIESEL FUEL SUPPLIED BY LOCAL STATION			

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS

TRPH CONCENTRATION	RESULTS		DETECTION LIMIT	
	110	MG/KG	10	MG/KG
CONTROL SPIKE	100	% RECOVERY		

SOIL: TS2NOV2-6'-7'; 11/2/93
PROJECT NAME: NAS FALLON

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (CONTINUED)

DUPLICATE CONTROL SPIKE	106	% RECOVERY
DATE RECEIVED	11/05/93	
DATE EXTRACTED	11/09/93	
DATE ANALYZED	11/17/93	
TOTAL SOLIDS (%)	78	
PH	7	

METHOD REFERENCES

ALKALINITY
STANDARD METHODS FOR THE EXAMINATION OF WATERS AND WASTEWATER, 17TH EDITION, METHOD 2320B, APHA, AWWA, WPCF, WASHINGTON, D.C. (1989).

ARSENIC
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS (3030, 3040, OR 3050) AND 7060, U.S. EPA, WASHINGTON, D.C. (REVISED APRIL 1984).
CONTRACT LABORATORY PROGRAM STATEMENT OF WORK NO. 785, METHOD 206.2 CLP-M, U.S. EPA, WASHINGTON, D. C. (JULY 1985).

LEAD
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS (3030, 3040 OR 3050) AND 7421, U.S. EPA, WASHINGTON, DC (REVISED APRIL 1984)

NITRATE-N
OFFICIAL METHODS OF ANALYSIS, 15TH EDITION, METHOD 973.50, AOAC, ARLINGTON, VIRGINIA (1990).

NITRITE-N
STANDARD METHODS FOR EXAMINATION OF WATER & WASTEWATER, 5TH EDITION, METHOD 4500-NO2 APHA, AWWA, WPCF, WASHINGTON, D.C. (1989).

SOIL: TS2NOV2-6'-7'; 11/2/93
PROJECT NAME: NAS FALLON

METHOD REFERENCES (CONTINUED)

BTEX ANALYSIS IN SOILS
EPA SW-846 METHOD 8021: "VOLATILE ORGANIC COMPOUNDS IN WATER BY PURGE AND TRAP CAPILLARY COLUMN GAS CHROMATOGRAPHY WITH PHOTINIZATION AND ELECTROLYTIC CONDUCTIVITY DETECTORS IN SERIES."
REV 0, DECEMBER 1987
U.S. EPA METHOD 602 (FEDERAL REGISTER, VOLUME 49, NO. 209, PG. 43261-43271, OCTOBER 26, 1984).
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS, 8020, 5030, U.S. EPA, WASHINGTON, DC(REVISED APRIL, 1984).

TOTAL ORGANIC CARBON - SOILS)
DETERMINATION OF TOTAL ORGANIC CARBON IN SEDIMENT. LLOYD KAHN, USEPA, REGION II, EDISON, NJ 08837. 7/27/88

TOTAL KJELDAHL NITROGEN-SOIL
SUBCONTRACTED ANALYSIS; EPA 351.3; RMT,INC., MADISON, WI.

TOTAL PHOSPHORUS
EPA 600/4-79-020, METHOD 365.2

PH IN SOILS
TEST METHODS FOR EVALUATING SOLID WASTE. USEPA, SW-846, THIRD EDITION, NOVEMBER 1990, METHOD 9045.

SUBCONTRACTED ANALYSIS
"METHODS OF SOIL ANALYSIS," PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965, PP 307-308. AMERICAN SOCIETY OF AGRONOMY. 1N AMMONIUM ACETATE EXTRACTION. DETERMINATION BY FLAME AA.

SUBCONTRACTED ANALYSIS
CATION EXCHANGE CAPACITY BY AMMONIUM SATURATION. METHOD IS A MODIFICATION OF THE METHOD DESCRIBED IN: "METHODS OF SOIL ANALYSIS," PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965, PP. 894-899. AMERICAN SOCIETY OF AGRONOMY.

SUBCONTRACTED ANALYSIS
"METHODS OF SOIL ANALYSIS, " PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965 PP 664-665. AMERICAN SOCIETY OF AGRONOMY. 1N KC1 (ACIDIFIED) EXTRACTION OF SOIL. MEASUREMENT BY ELECTRODE.

TOTAL PETROLEUM HYDROCARBONS/DIESEL
STATE OF CALIFORNIA LUFT METHOD

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS
WI DNR MODIFIED VERSION OF EPA DRAFT METHOD 9073.

Hazleton Environmental Services, Inc.

REPORT OF ANALYSIS

BATTELLE MEMORIAL INSTITUTE
J. KITTEL
505 KING AVENUE
COLUMBUS, OH 43201-2693

SAMPLE NUMBER: 31100831
DATE ENTERED: 11/08/93
REPORT PRINTED: 12/20/93

SOIL: TS2NOV2-8'-9'; 11/2/93
PROJECT NAME: NAS FALLON

PURCHASE ORDER NUMBER: 66744

ASSAY	ANALYSIS	UNITS
ALKALINITY	1840.	MG/KG
ARSENIC	23.7	PPM
LEAD	7.7	PPM
NITRATE-N	< 1.23	MG/KG
NITRITE-N	< .20	MG/KG

BTEX ANALYSIS IN SOILS

COMPOUND NAME	DILUTION FACTOR	DETECTION LIMIT	CONC UG/L
BENZENE	500	620	< 620
TOLUENE	500	620	1800
ETHYLBENZENE	500	620	< 620
m AND p-XYLENE	500	1200	< 1200
o-XYLENE	500	620	2900
FLUOROBENZENE (SURROGATE)	94		
DATE ANALYZED	11/15/93		
DATE RECEIVED	11/05/93		

TOTAL ORGANIC CARBON - SOILS)	765.	PPM
TOTAL KJELDAHL NITROGEN-SOIL	140.	MG/KG
TOTAL PHOSPHORUS	1.39	MG/KG

SOIL: TS2NOV2-8'-9'; 11/2/93
PROJECT NAME: NAS FALLON

ASSAY	ANALYSIS	UNITS
PH IN SOILS	9.28	

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
PARTICAL SIZE		
SAND	35	%
SILT	46	%
CLAY	19	%

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
CATION EXCHANGE CAPACITY	19.22	MEQ/100G

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
EXCHANGEABLE AMMONIUM-NITROGEN	< 3	PPM

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
EXCHANGEABLE IRON	< 1	PPM

TOTAL PETROLEUM HYDROCARBONS/DIESEL

DIESEL	CONCENTRATION		DETECTION LIMIT	
DRY WEIGHT	7000	MG/KG	4000	MG/KG

CONTROL SPIKE	113	% RECOVERY
DUPLICATE CONTROL SPIKE	107	% RECOVERY
DILUTION FACTOR	400	
DATE RECEIVED	11/05/93	
DATE EXTRACTED	11/16/93	
DATE ANALYZED	12/13/93	
DRO STANDARD SOURCE	DIESEL FUEL SUPPLIED BY LOCAL STATION	

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS

TRPH CONCENTRATION	RESULTS		DETECTION LIMIT	
	3900	MG/KG	20	MG/KG
CONTROL SPIKE	100	% RECOVERY		

SOIL: TS2NOV2-8'-9'; 11/2/93
PROJECT NAME: NAS FALLON

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (CONTINUED)

DUPLICATE CONTROL SPIKE	106	% RECOVERY
DATE RECEIVED	11/05/93	
DATE EXTRACTED	11/09/93	
DATE ANALYZED	11/17/93	
TOTAL SOLIDS (%)	81	
PH	8	

METHOD REFERENCES

ALKALINITY
STANDARD METHODS FOR THE EXAMINATION OF WATERS AND WASTEWATER, 17TH EDITION, METHOD 2320B, APHA, AWWA, WPCF, WASHINGTON, D.C. (1989).

ARSENIC
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS (3030, 3040, OR 3050) AND 7060, U.S. EPA, WASHINGTON, D.C. (REVISED APRIL 1984).
CONTRACT LABORATORY PROGRAM STATEMENT OF WORK NO. 785, METHOD 206.2 CLP-M, U.S. EPA, WASHINGTON, D. C. (JULY 1985).

LEAD
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS (3030, 3040 OR 3050) AND 7421, U.S. EPA, WASHINGTON, DC (REVISED APRIL 1984)

NITRATE-N
OFFICIAL METHODS OF ANALYSIS, 15TH EDITION, METHOD 973.50, AOAC, ARLINGTON, VIRGINIA (1990).

NITRITE-N
STANDARD METHODS FOR EXAMINATION OF WATER & WASTEWATER, 5TH EDITION, METHOD 4500-NO2 APHA, AWWA, WPCF, WASHINGTON, D.C. (1989).

SOIL: TS2NOV2-8'-9'; 11/2/93
PROJECT NAME: NAS FALLON

METHOD REFERENCES (CONTINUED)

BTEX ANALYSIS IN SOILS
EPA SW-846 METHOD 8021: "VOLATILE ORGANIC COMPOUNDS IN WATER BY PURGE AND TRAP CAPILLARY COLUMN GAS CHROMATOGRAPHY WITH PHOTINIZATION AND ELECTROLYTIC CONDUCTIVITY DETECTORS IN SERIES."
REV O, DECEMBER 1987
U.S. EPA METHOD 602 (FEDERAL REGISTER, VOLUME 49, NO. 209, PG. 43261-43271, OCTOBER 26, 1984).
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS, 8020, 5030, U.S. EPA, WASHINGTON, DC(REVISED APRIL, 1984).

TOTAL ORGANIC CARBON - SOILS)
DETERMINATION OF TOTAL ORGANIC CARBON IN SEDIMENT. LLOYD KAHN, USEPA, REGION II, EDISON, NJ 08837. 7/27/88

TOTAL KJELDAHL NITROGEN-SOIL
SUBCONTRACTED ANALYSIS; EPA 351.3; RMT,INC., MADISON, WI.

TOTAL PHOSPHORUS
EPA 600/4-79-020, METHOD 365.2

PH IN SOILS
TEST METHODS FOR EVALUATING SOLID WASTE. USEPA, SW-846, THIRD EDITION, NOVEMBER 1990, METHOD 9045.

SUBCONTRACTED ANALYSIS
"METHODS OF SOIL ANALYSIS," PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965, PP 307-308. AMERICAN SOCIETY OF AGRONOMY. 1N AMMONIUM ACETATE EXTRACTION. DETERMINATION BY FLAME AA.

SUBCONTRACTED ANALYSIS
CATION EXCHANGE CAPACITY BY AMMONIUM SATURATION. METHOD IS A MODIFICATION OF THE METHOD DESCRIBED IN: "METHODS OF SOIL ANALYSIS," PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965, PP. 894-899. AMERICAN SOCIETY OF AGRONOMY.

SUBCONTRACTED ANALYSIS
"METHODS OF SOIL ANALYSIS, " PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965 PP 664-665. AMERICAN SOCIETY OF AGRONOMY. 1N KC1 (ACIDIFIED) EXTRACTION OF SOIL. MEASUREMENT BY ELECTRODE.

TOTAL PETROLEUM HYDROCARBONS/DIESEL
STATE OF CALIFORNIA LUFT METHOD

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS
WI DNR MODIFIED VERSION OF EPA DRAFT METHOD 9073.

Hazleton Environmental Services, Inc.

REPORT OF ANALYSIS

BATTELLE MEMORIAL INSTITUTE
J. KITTEL
505 KING AVENUE
COLUMBUS, OH 43201-2693

SAMPLE NUMBER: 31100832
DATE ENTERED: 11/08/93
REPORT PRINTED: 12/20/93

SOIL: BKNOV2-2'-3'; 11/2/93
PROJECT NAME: NAS FALLON

PURCHASE ORDER NUMBER: 66744

ASSAY	ANALYSIS	UNITS
ALKALINITY	1040.	MG/KG
ARSENIC	3.6	PPM
LEAD	5.2	PPM
NITRATE-N	< 1.12	MG/KG
NITRITE-N	< .20	MG/KG

BTEX ANALYSIS IN SOILS

COMPOUND NAME	DILUTION FACTOR	DETECTION LIMIT	CONC UG/L
BENZENE	1	1.1	< 1.1
TOLUENE	1	1.1	4.5
ETHYLBENZENE	1	1.1	< 1.1
m AND p-XYLENE	1	2.2	< 2.2
o-XYLENE	1	1.1	< 1.1
FLUOROBENZENE (SURROGATE)	94		
DATE ANALYZED	11/15/93		
DATE RECEIVED	11/05/93		

TOTAL ORGANIC CARBON - SOILS)	428.	PPM
TOTAL KJELDAHL NITROGEN-SOIL	540.	MG/KG
TOTAL PHOSPHORUS	.418	MG/KG

SOIL: BKNOV2-2'-3'; 11/2/93
PROJECT NAME: NAS FALLON

ASSAY	ANALYSIS	UNITS
PH IN SOILS	9.14	

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
PARTICAL SIZE		
SAND	71	%
SILT	16	%
CLAY	13	%

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
CATION EXCHANGE CAPACITY	6.66	MEQ/100G

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
EXCHANGEABLE AMMONIUM-NITROGEN	< 3	PPM

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
EXCHANGEABLE IRON	< 1	PPM

TOTAL PETROLEUM HYDROCARBONS/DIESEL

DIESEL	CONCENTRATION		DETECTION LIMIT	
DRY WEIGHT	< 10	MG/KG	10	MG/KG
CONTROL SPIKE	113	% RECOVERY		
DUPLICATE CONTROL SPIKE	107	% RECOVERY		
DILUTION FACTOR	1			
DATE RECEIVED	11/05/93			
DATE EXTRACTED	11/16/93			
DATE ANALYZED	12/10/93			
DRO STANDARD SOURCE	DIESEL FUEL SUPPLIED BY LOCAL STATION			

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS

TRPH CONCENTRATION	RESULTS		DETECTION LIMIT	
	37	MG/KG	10	MG/KG
CONTROL SPIKE	100	% RECOVERY		

SOIL: BKNOV2-2'-3'; 11/2/93
PROJECT NAME: NAS FALLON

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (CONTINUED)

DUPLICATE CONTROL SPIKE	106	% RECOVERY
DATE RECEIVED	11/05/93	
DATE EXTRACTED	11/09/93	
DATE ANALYZED	11/17/93	
TOTAL SOLIDS (%)	90	
PH	8	

METHOD REFERENCES

ALKALINITY
STANDARD METHODS FOR THE EXAMINATION OF WATERS AND WASTEWATER, 17TH EDITION, METHOD 2320B, APHA, AWWA, WPCF, WASHINGTON, D.C. (1989).

ARSENIC
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS (3030, 3040, OR 3050) AND 7060, U.S. EPA, WASHINGTON, D.C. (REVISED APRIL 1984).
CONTRACT LABORATORY PROGRAM STATEMENT OF WORK NO. 785, METHOD 206.2 CLP-M, U.S. EPA, WASHINGTON, D. C. (JULY 1985).

LEAD
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS (3030, 3040 OR 3050) AND 7421, U.S. EPA, WASHINGTON, DC (REVISED APRIL 1984)

NITRATE-N
OFFICIAL METHODS OF ANALYSIS, 15TH EDITION, METHOD 973.50, AOAC, ARLINGTON, VIRGINIA (1990).

NITRITE-N
STANDARD METHODS FOR EXAMINATION OF WATER & WASTEWATER, 5TH EDITION, METHOD 4500-NO2 APHA, AWWA, WPCF, WASHINGTON, D.C. (1989).

SOIL: BKNOV2-2'-3'; 11/2/93
PROJECT NAME: NAS FALLON

METHOD REFERENCES (CONTINUED)

BTEX ANALYSIS IN SOILS
EPA SW-846 METHOD 8021: "VOLATILE ORGANIC COMPOUNDS IN WATER BY PURGE AND TRAP CAPILLARY COLUMN GAS CHROMATOGRAPHY WITH PHOTINIZATION AND ELECTROLYTIC CONDUCTIVITY DETECTORS IN SERIES."
REV 0, DECEMBER 1987
U.S. EPA METHOD 602 (FEDERAL REGISTER, VOLUME 49, NO. 209, PG. 43261-43271, OCTOBER 26, 1984).
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS, 8020, 5030, U.S. EPA, WASHINGTON, DC(REVISED APRIL, 1984).

TOTAL ORGANIC CARBON - SOILS)
DETERMINATION OF TOTAL ORGANIC CARBON IN SEDIMENT. LLOYD KAHN, USEPA, REGION II, EDISON, NJ 08837. 7/27/88

TOTAL KJELDAHL NITROGEN-SOIL
SUBCONTRACTED ANALYSIS; EPA 351.3; RMT,INC., MADISON, WI.

TOTAL PHOSPHORUS
EPA 600/4-79-020, METHOD 365.2

PH IN SOILS
TEST METHODS FOR EVALUATING SOLID WASTE. USEPA, SW-846, THIRD EDITION, NOVEMBER 1990, METHOD 9045.

SUBCONTRACTED ANALYSIS
"METHODS OF SOIL ANALYSIS," PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965, PP 307-308. AMERICAN SOCIETY OF AGRONOMY. 1N AMMONIUM ACETATE EXTRACTION. DETERMINATION BY FLAME AA.

SUBCONTRACTED ANALYSIS
CATION EXCHANGE CAPACITY BY AMMONIUM SATURATION. METHOD IS A MODIFICATION OF THE METHOD DESCRIBED IN: "METHODS OF SOIL ANALYSIS," PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965, PP. 894-899. AMERICAN SOCIETY OF AGRONOMY.

SUBCONTRACTED ANALYSIS
"METHODS OF SOIL ANALYSIS, " PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965 PP 664-665. AMERICAN SOCIETY OF AGRONOMY. 1N KC1 (ACIDIFIED) EXTRACTION OF SOIL. MEASUREMENT BY ELECTRODE.

SUBCONTRACTED ANALYSIS
ASSAY NAME AND METHOD LISTED ABOVE WITH RESULTS.

TOTAL PETROLEUM HYDROCARBONS/DIESEL
STATE OF CALIFORNIA LUFT METHOD

SOIL: BKNOV2-2'-3'; 11/2/93
PROJECT NAME: NAS FALLON

METHOD REFERENCES (CONTINUED)

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS
WI DNR MODIFIED VERSION OF EPA DRAFT METHOD 9073.

Hazleton Environmental Services, Inc.

REPORT OF ANALYSIS

BATTELLE MEMORIAL INSTITUTE
J. KITTEL
505 KING AVENUE
COLUMBUS, OH 43201-2693

SAMPLE NUMBER: 3110081
DATE ENTERED: 11/08/93
REPORT PRINTED: 12/20/93

SOIL: BKNOV2-5'-6'; 11/2/93
PROJECT NAME: NAS FALLON

PURCHASE ORDER NUMBER: 66744

ASSAY	ANALYSIS	UNITS
ALKALINITY	547.	MG/KG
ARSENIC	26.3	PPM
LEAD	5.7	PPM
NITRATE-N	< 1.15	MG/KG
NITRITE-N	< .20	MG/KG

BTEX ANALYSIS IN SOILS

COMPOUND NAME	DILUTION FACTOR	DETECTION LIMIT	CONC UG/L
BENZENE	1	1.1	< 1.1
TOLUENE	1	1.1	4.1
ETHYLBENZENE	1	1.1	< 1.1
m AND p-XYLENE	1	2.3	< 2.3
o-XYLENE	1	1.1	< 1.1
FLUOROBENZENE (SURROGATE)	92		
DATE ANALYZED	11/15/93		
DATE RECEIVED	11/05/93		

TOTAL ORGANIC CARBON - SOILS)	405.	PPM
TOTAL KJELDAHL NITROGEN-SOIL	150.	MG/KG
TOTAL PHOSPHORUS	.426	MG/KG

SAMPLE NUMBER: 31100833

SOIL: BKNOV2-5'-6'; 11/2/93
PROJECT NAME: NAS FALLON

ASSAY	ANALYSIS	UNITS
PH IN SOILS	8.95	

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
PARTICAL SIZE		
SAND	67	%
SILT	18	%
CLAY	15	%

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
CATION EXCHANGE CAPACITY	6.41	MEQ/100G

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
EXCHANGEABLE AMMONIUM-NITROGEN	< 3	PPM

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
EXCHANGEABLE IRON	< 1	PPM

TOTAL PETROLEUM HYDROCARBONS/DIESEL

DIESEL	CONCENTRATION		DETECTION LIMIT	
DRY WEIGHT	< 10	MG/KG	10	MG/KG
CONTROL SPIKE	113	% RECOVERY		
DUPLICATE CONTROL SPIKE	107	% RECOVERY		
DILUTION FACTOR	1			
DATE RECEIVED	11/05/93			
DATE EXTRACTED	11/16/93			
DATE ANALYZED	12/10/93			
DRO STANDARD SOURCE	DIESEL FUEL SUPPLIED BY LOCAL STATION			

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS

TRPH CONCENTRATION	RESULTS		DETECTION LIMIT	
	80	MG/KG	10	MG/KG
CONTROL SPIKE	100	% RECOVERY		

SOIL: BKNOV2-5'-6'; 11/2/93
PROJECT NAME: NAS FALLON

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (CONTINUED)

DUPLICATE CONTROL SPIKE	106	% RECOVERY
DATE RECEIVED	11/05/93	
DATE EXTRACTED	11/09/93	
DATE ANALYZED	11/17/93	
TOTAL SOLIDS (%)	87	
PH	7	

METHOD REFERENCES

ALKALINITY
STANDARD METHODS FOR THE EXAMINATION OF WATERS AND WASTEWATER, 17TH EDITION, METHOD 2320B, APHA, AWWA, WPCF, WASHINGTON, D.C. (1989).

ARSENIC
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS (3030, 3040, OR 3050) AND 7060, U.S. EPA, WASHINGTON, D.C. (REVISED APRIL 1984).
CONTRACT LABORATORY PROGRAM STATEMENT OF WORK NO. 785, METHOD 206.2 CLP-M, U.S. EPA, WASHINGTON, D. C. (JULY 1985).

LEAD
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS (3030, 3040 OR 3050) AND 7421, U.S. EPA, WASHINGTON, DC (REVISED APRIL 1984)

NITRATE-N
OFFICIAL METHODS OF ANALYSIS, 15TH EDITION, METHOD 973.50, AOAC, ARLINGTON, VIRGINIA (1990).

NITRITE-N
STANDARD METHODS FOR EXAMINATION OF WATER & WASTEWATER, 5TH EDITION, METHOD 4500-NO2 APHA, AWWA, WPCF, WASHINGTON, D.C. (1989).

SOIL: BKNOV2-5'-6'; 11/2/93
PROJECT NAME: NAS FALLON

METHOD REFERENCES (CONTINUED)

BTEX ANALYSIS IN SOILS
EPA SW-846 METHOD 8021: "VOLATILE ORGANIC COMPOUNDS IN WATER BY PURGE AND TRAP CAPILLARY COLUMN GAS CHROMATOGRAPHY WITH PHOTINIZATION AND ELECTROLYTIC CONDUCTIVITY DETECTORS IN SERIES."
REV 0, DECEMBER 1987
U.S. EPA METHOD 602 (FEDERAL REGISTER, VOLUME 49, NO. 209, PG. 43261-43271, OCTOBER 26, 1984).
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS, 8020, 5030, U.S. EPA, WASHINGTON, DC(REVISED APRIL, 1984).

TOTAL ORGANIC CARBON - SOILS)
DETERMINATION OF TOTAL ORGANIC CARBON IN SEDIMENT. LLOYD KAHN, USEPA, REGION II, EDISON, NJ 08837. 7/27/88

TOTAL KJELDAHL NITROGEN-SOIL
SUBCONTRACTED ANALYSIS; EPA 351.3; RMT,INC., MADISON, WI.

TOTAL PHOSPHORUS
EPA 600/4-79-020, METHOD 365.2

PH IN SOILS
TEST METHODS FOR EVALUATING SOLID WASTE. USEPA, SW-846, THIRD EDITION, NOVEMBER 1990, METHOD 9045.

SUBCONTRACTED ANALYSIS
"METHODS OF SOIL ANALYSIS," PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965, PP 307-308. AMERICAN SOCIETY OF AGRONOMY. 1N AMMONIUM ACETATE EXTRACTION. DETERMINATION BY FLAME AA.

SUBCONTRACTED ANALYSIS
CATION EXCHANGE CAPACITY BY AMMONIUM SATURATION. METHOD IS A MODIFICATION OF THE METHOD DESCRIBED IN: "METHODS OF SOIL ANALYSIS," PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965, PP. 894-899. AMERICAN SOCIETY OF AGRONOMY.

SUBCONTRACTED ANALYSIS
"METHODS OF SOIL ANALYSIS, " PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965 PP 664-665. AMERICAN SOCIETY OF AGRONOMY. 1N KC1 (ACIDIFIED) EXTRACTION OF SOIL. MEASUREMENT BY ELECTRODE.

SUBCONTRACTED ANALYSIS
ASSAY NAME AND METHOD LISTED ABOVE WITH RESULTS.

TOTAL PETROLEUM HYDROCARBONS/DIESEL
STATE OF CALIFORNIA LUFT METHOD

SOIL: BKNOV2-5'-6'; 11/2/93
PROJECT NAME: NAS FALLON

METHOD REFERENCES (CONTINUED)

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS
WI DNR MODIFIED VERSION OF EPA DRAFT METHOD 9073.

Hazleton Environmental Services, Inc.

REPORT OF ANALYSIS

BATTELLE MEMORIAL INSTITUTE
J. KITTEL
505 KING AVENUE
COLUMBUS, OH 43201-2693

SAMPLE NUMBER: 31100834
DATE ENTERED: 11/08/93
REPORT PRINTED: 12/20/93

SOIL: BKNOV2-7'-8'; 11/2/93
PROJECT NAME: NAS FALLON

PURCHASE ORDER NUMBER: 66744

ASSAY	ANALYSIS	UNITS
ALKALINITY	1670.	MG/KG
ARSENIC	64.2	PPM
LEAD	12.2	PPM
NITRATE-N	< 1.33	MG/KG
NITRITE-N	< .20	MG/KG

BTEX ANALYSIS IN SOILS

COMPOUND NAME	DILUTION FACTOR	DETECTION LIMIT	CONC UG/L
BENZENE	1	1.4	< 1.4
TOLUENE	1	1.4	11
ETHYLBENZENE	1	1.4	< 1.4
m AND p-XYLENE	1	2.8	< 2.8
o-XYLENE	1	1.4	< 1.4
FLUOROBENZENE (SURROGATE)	85		
DATE ANALYZED	11/15/93		
DATE RECEIVED	11/05/93		

TOTAL ORGANIC CARBON - SOILS)	1150.	PPM
TOTAL KJELDAHL NITROGEN-SOIL	250.	MG/KG
TOTAL PHOSPHORUS	2.06	MG/KG

SOIL: BKNOV2-7'-8'; 11/2/93
PROJECT NAME: NAS FALLON

ASSAY	ANALYSIS	UNITS
PH IN SOILS	9.03	

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
PARTICAL SIZE		
SAND	17	%
SILT	56	%
CLAY	27	%

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
CATION EXCHANGE CAPACITY	32.29	MEQ/100G

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
EXCHANGEABLE AMMONIUM-NITROGEN	< 3	PPM

SUBCONTRACTED ANALYSIS

CANCELLED; INSUFFICIENT SAMPLE

TOTAL PETROLEUM HYDROCARBONS/DIESEL

DIESEL	CONCENTRATION		DETECTION LIMIT	
DRY WEIGHT	< 10	MG/KG	10	MG/KG
CONTROL SPIKE	113	% RECOVERY		
DUPLICATE CONTROL SPIKE	107	% RECOVERY		
DILUTION FACTOR	1			
DATE RECEIVED	11/05/93			
DATE EXTRACTED	11/16/93			
DATE ANALYZED	12/10/93			
DRO STANDARD SOURCE	DIESEL FUEL SUPPLIED BY LOCAL STATION			

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS

TRPH CONCENTRATION	RESULTS		DETECTION LIMIT	
	46	MG/KG	10	MG/KG
CONTROL SPIKE	100	% RECOVERY		
DUPLICATE CONTROL SPIKE	106	% RECOVERY		

SOIL: BKNOV2-7'-8'; 11/2/93
PROJECT NAME: NAS FALLON

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (CONTINUED)

DATE RECEIVED	11/05/93
DATE EXTRACTED	11/09/93
DATE ANALYZED	11/17/93
TOTAL SOLIDS (%)	73
PH	8

METHOD REFERENCES

ALKALINITY
STANDARD METHODS FOR THE EXAMINATION OF WATERS AND WASTEWATER, 17TH EDITION, METHOD 2320B, APHA, AWWA, WPCF, WASHINGTON, D.C. (1989).

ARSENIC
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS (3030, 3040, OR 3050) AND 7060, U.S. EPA, WASHINGTON, D.C. (REVISED APRIL 1984).
CONTRACT LABORATORY PROGRAM STATEMENT OF WORK NO. 785, METHOD 206.2 CLP-M, U.S. EPA, WASHINGTON, D. C. (JULY 1985).

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NITRATE-N
OFFICIAL METHODS OF ANALYSIS, 15TH EDITION, METHOD 973.50, AOAC, ARLINGTON, VIRGINIA (1990).

NITRITE-N
STANDARD METHODS FOR EXAMINATION OF WATER & WASTEWATER, 5TH EDITION, METHOD 4500-NO2 APHA, AWWA, WPCF, WASHINGTON, D.C. (1989).

SOIL: BKNOV2-7'-8'; 11/2/93
PROJECT NAME: NAS FALLON

METHOD REFERENCES (CONTINUED)

BTEX ANALYSIS IN SOILS
EPA SW-846 METHOD 8021: "VOLATILE ORGANIC COMPOUNDS IN WATER BY PURGE AND TRAP CAPILLARY COLUMN GAS CHROMATOGRAPHY WITH PHOTINIZATION AND ELECTROLYTIC CONDUCTIVITY DETECTORS IN SERIES."
REV O, DECEMBER 1987
U.S. EPA METHOD 602 (FEDERAL REGISTER, VOLUME 49, NO. 209, PG. 43261-43271, OCTOBER 26, 1984).
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS, 8020, 5030, U.S. EPA, WASHINGTON, DC(REVISED APRIL, 1984).

TOTAL ORGANIC CARBON - SOILS)
DETERMINATION OF TOTAL ORGANIC CARBON IN SEDIMENT. LLOYD KAHN, USEPA, REGION II, EDISON, NJ 08837. 7/27/88

TOTAL KJELDAHL NITROGEN-SOIL
SUBCONTRACTED ANALYSIS; EPA 351.3; RMT,INC., MADISON, WI.

TOTAL PHOSPHORUS
EPA 600/4-79-020, METHOD 365.2

PH IN SOILS
TEST METHODS FOR EVALUATING SOLID WASTE. USEPA, SW-846, THIRD EDITION, NOVEMBER 1990, METHOD 9045.

SUBCONTRACTED ANALYSIS
"METHODS OF SOIL ANALYSIS," PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965, PP 307-308. AMERICAN SOCIETY OF AGRONOMY. 1N AMMONIUM ACETATE EXTRACTION. DETERMINATION BY FLAME AA.

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CATION EXCHANGE CAPACITY BY AMMONIUM SATURATION. METHOD IS A MODIFICATION OF THE METHOD DESCRIBED IN: "METHODS OF SOIL ANALYSIS," PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965, PP. 894-899. AMERICAN SOCIETY OF AGRONOMY.

SUBCONTRACTED ANALYSIS
"METHODS OF SOIL ANALYSIS, " PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965 PP 664-665. AMERICAN SOCIETY OF AGRONOMY. 1N KC1 (ACIDIFIED) EXTRACTION OF SOIL. MEASUREMENT BY ELECTRODE.

SUBCONTRACTED ANALYSIS
ASSAY NAME AND METHOD LISTED ABOVE WITH RESULTS.

TOTAL PETROLEUM HYDROCARBONS/DIESEL
STATE OF CALIFORNIA LUFT METHOD

SOIL: BKNOV2-7'-8'; 11/2/93
PROJECT NAME: NAS FALLON

METHOD REFERENCES (CONTINUED)

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS
WI DNR MODIFIED VERSION OF EPA DRAFT METHOD 9073.

Hazleton Environmental Services, Inc.

REPORT OF ANALYSIS

BATTELLE MEMORIAL INSTITUTE
J. KITTEL
505 KING AVENUE
COLUMBUS, OH 43201-2693

SAMPLE NUMBER: 3110083
DATE ENTERED: 11/08/93
REPORT PRINTED: 12/20/93

SOIL: FFNOV2-2'-3'; 11/2/93
PROJECT NAME: NAS FALLON

PURCHASE ORDER NUMBER: 66744

ASSAY	ANALYSIS	UNITS
ALKALINITY	494.	MG/KG
ARSENIC	14.1	PPM
LEAD	9.7	PPM
NITRATE-N	8.36	MG/KG
NITRITE-N	< .20	MG/KG

BTEX ANALYSIS IN SOILS

COMPOUND NAME	DILUTION FACTOR	DETECTION LIMIT	CONC UG/L
BENZENE	1	1.2	< 1.2
TOLUENE	1	1.2	4.5
ETHYLBENZENE	1	1.2	< 1.2
m AND p-XYLENE	1	2.5	< 2.5
o-XYLENE	1	1.2	< 1.2
FLUOROBENZENE (SURROGATE)	88		
DATE ANALYZED	11/15/93		
DATE RECEIVED	11/05/93		

TOTAL ORGANIC CARBON - SOILS)	1110.	PPM
TOTAL KJELDAHL NITROGEN-SOIL	230.	MG/KG
TOTAL PHOSPHORUS	1.08	MG/KG

SOIL: FFNOV2-2'-3'; 11/2/93
PROJECT NAME: NAS FALLON

ASSAY	ANALYSIS	UNITS
PH IN SOILS	8.34	

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
PARTICAL SIZE		
SAND	39	%
SILT	32	%
CLAY	29	%

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
CATION EXCHANGE CAPACITY	26.35	MEQ/100G

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
EXCHANGEABLE AMMONIUM-NITROGEN	< 3	PPM

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
EXCHANGEABLE IRON	< 1	PPM

TOTAL PETROLEUM HYDROCARBONS/DIESEL

DIESEL	CONCENTRATION		DETECTION LIMIT	
DRY WEIGHT	< 10	MG/KG	10	MG/KG
CONTROL SPIKE	113	% RECOVERY		
DUPLICATE CONTROL SPIKE	107	% RECOVERY		
DILUTION FACTOR	1			
DATE RECEIVED	11/05/93			
DATE EXTRACTED	11/16/93			
DATE ANALYZED	12/10/93			
DRO STANDARD SOURCE	DIESEL FUEL SUPPLIED BY LOCAL STATION			

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS

TRPH CONCENTRATION	RESULTS		DETECTION LIMIT	
	65	MG/KG	10	MG/KG
CONTROL SPIKE	100	% RECOVERY		

SOIL: FFNOV2-2'-3'; 11/2/93
PROJECT NAME: NAS FALLON

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (CONTINUED)

DUPLICATE CONTROL SPIKE	106 % RECOVERY
DATE RECEIVED	11/05/93
DATE EXTRACTED	11/09/93
DATE ANALYZED	11/17/93
TOTAL SOLIDS (%)	80
PH	6

METHOD REFERENCES

ALKALINITY
STANDARD METHODS FOR THE EXAMINATION OF WATERS AND WASTEWATER, 17TH EDITION, METHOD 2320B, APHA, AWWA, WPCF, WASHINGTON, D.C. (1989).

ARSENIC
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS (3030, 3040, OR 3050) AND 7060, U.S. EPA, WASHINGTON, D.C. (REVISED APRIL 1984).
CONTRACT LABORATORY PROGRAM STATEMENT OF WORK NO. 785, METHOD 206.2 CLP-M, U.S. EPA, WASHINGTON, D. C. (JULY 1985).

LEAD
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS (3030, 3040 OR 3050) AND 7421, U.S. EPA, WASHINGTON, DC (REVISED APRIL 1984)

NITRATE-N
OFFICIAL METHODS OF ANALYSIS, 15TH EDITION, METHOD 973.50, AOAC, ARLINGTON, VIRGINIA (1990).

NITRITE-N
STANDARD METHODS FOR EXAMINATION OF WATER & WASTEWATER, 5TH EDITION, METHOD 4500-NO2 APHA, AWWA, WPCF, WASHINGTON, D.C. (1989).

SOIL: FFNOV2-2'-3'; 11/2/93
PROJECT NAME: NAS FALLON

METHOD REFERENCES (CONTINUED)

BTEX ANALYSIS IN SOILS
EPA SW-846 METHOD 8021: "VOLATILE ORGANIC COMPOUNDS IN WATER BY PURGE AND TRAP CAPILLARY COLUMN GAS CHROMATOGRAPHY WITH PHOTINIZATION AND ELECTROLYTIC CONDUCTIVITY DETECTORS IN SERIES."
REV 0, DECEMBER 1987
U.S. EPA METHOD 602 (FEDERAL REGISTER, VOLUME 49, NO. 209, PG. 43261-43271, OCTOBER 26, 1984).
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS, 8020, 5030, U.S. EPA, WASHINGTON, DC(REVISED APRIL, 1984).

TOTAL ORGANIC CARBON - SOILS)
DETERMINATION OF TOTAL ORGANIC CARBON IN SEDIMENT. LLOYD KAHN, USEPA, REGION II, EDISON, NJ 08837. 7/27/88

TOTAL KJELDAHL NITROGEN-SOIL
SUBCONTRACTED ANALYSIS; EPA 351.3; RMT,INC., MADISON, WI.

TOTAL PHOSPHORUS
EPA 600/4-79-020, METHOD 365.2

PH IN SOILS
TEST METHODS FOR EVALUATING SOLID WASTE. USEPA, SW-846, THIRD EDITION, NOVEMBER 1990, METHOD 9045.

SUBCONTRACTED ANALYSIS
"METHODS OF SOIL ANALYSIS," PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965, PP 307-308. AMERICAN SOCIETY OF AGRONOMY. 1N AMMONIUM ACETATE EXTRACTION. DETERMINATION BY FLAME AA.

SUBCONTRACTED ANALYSIS
CATION EXCHANGE CAPACITY BY AMMONIUM SATURATION. METHOD IS A MODIFICATION OF THE METHOD DESCRIBED IN: "METHODS OF SOIL ANALYSIS," PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965, PP. 894-899. AMERICAN SOCIETY OF AGRONOMY.

SUBCONTRACTED ANALYSIS
"METHODS OF SOIL ANALYSIS, " PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965 PP 664-665. AMERICAN SOCIETY OF AGRONOMY. 1N KC1 (ACIDIFIED) EXTRACTION OF SOIL. MEASUREMENT BY ELECTRODE.

SUBCONTRACTED ANALYSIS
ASSAY NAME AND METHOD LISTED ABOVE WITH RESULTS.

TOTAL PETROLEUM HYDROCARBONS/DIESEL
STATE OF CALIFORNIA LUFT METHOD

SOIL: FFNOV2-2'-3'; 11/2/93
PROJECT NAME: NAS FALLON

METHOD REFERENCES (CONTINUED)

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS
WI DNR MODIFIED VERSION OF EPA DRAFT METHOD 9073.

Hazleton
Environmental
Services, Inc.

REPORT OF ANALYSIS

BATTELLE MEMORIAL INSTITUTE
J. KITTEL
505 KING AVENUE
COLUMBUS, OH 43201-2693

SAMPLE NUMBER: 31100836
DATE ENTERED: 11/08/93
REPORT PRINTED: 12/20/93

SOIL: FFNOV2-6'-7'; 11/2/93
PROJECT NAME: NAS FALLON

PURCHASE ORDER NUMBER: 66744

ASSAY	ANALYSIS	UNITS
ALKALINITY	1470.	MG/KG
ARSENIC	17.4	PPM
LEAD	7.9	PPM
NITRATE-N	2.10	MG/KG
NITRITE-N	.251	MG/KG

BTEX ANALYSIS IN SOILS

COMPOUND NAME	DILUTION FACTOR	DETECTION LIMIT	CONC UG/L
BENZENE	500	640	< 640
TOLUENE	500	640	1900
ETHYLBENZENE	500	640	2400
m AND p-XYLENE	500	1300	9700
o-XYLENE	500	640	7300
FLUOROBENZENE (SURROGATE)	102		
DATE ANALYZED	11/16/93		
DATE RECEIVED	11/05/93		

TOTAL ORGANIC CARBON - SOILS)	1050.	PPM
TOTAL KJELDAHL NITROGEN-SOIL	110.	MG/KG
TOTAL PHOSPHORUS	.521	MG/KG

SOIL: FFNOV2-6'-7'; 11/2/93
PROJECT NAME: NAS FALLON

ASSAY	ANALYSIS	UNITS
PH IN SOILS	9.14	

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
PARTICAL SIZE		
SAND	37	%
SILT	42	%
CLAY	21	%

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
CATION EXCHANGE CAPACITY	17.14	MEQ/100G

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
EXCHANGEABLE AMMONIUM-NITROGEN	< 3	PPM

SUBCONTRACTED ANALYSIS

PARAMETER	RESULTS	UNITS
EXCHANGEABLE IRON	< 1	PPM

TOTAL PETROLEUM HYDROCARBONS/DIESEL

DIESEL	CONCENTRATION		DETECTION LIMIT	
DRY WEIGHT	5800	MG/KG	4000	MG/KG

CONTROL SPIKE	113	% RECOVERY
DUPLICATE CONTROL SPIKE	107	% RECOVERY
DILUTION FACTOR	400	
DATE RECEIVED	11/05/93	
DATE EXTRACTED	11/16/93	
DATE ANALYZED	12/13/93	
DRO STANDARD SOURCE	DIESEL FUEL SUPPLIED BY LOCAL STATION	

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS

TRPH CONCENTRATION	RESULTS		DETECTION LIMIT	
	4300	MG/KG	20	MG/KG
CONTROL SPIKE	100	% RECOVERY		

SOIL: FFNOV2-6'-7'; 11/2/93
PROJECT NAME: NAS FALLON

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (CONTINUED)

DUPLICATE CONTROL SPIKE	106	% RECOVERY
DATE RECEIVED	11/05/93	
DATE EXTRACTED	11/09/93	
DATE ANALYZED	11/17/93	
TOTAL SOLIDS (%)	78	
PH	8	

METHOD REFERENCES

ALKALINITY
STANDARD METHODS FOR THE EXAMINATION OF WATERS AND WASTEWATER, 17TH EDITION, METHOD 2320B, APHA, AWWA, WPCF, WASHINGTON, D.C. (1989).

ARSENIC
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS (3030, 3040, OR 3050) AND 7060, U.S. EPA, WASHINGTON, D.C. (REVISED APRIL 1984).
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OFFICIAL METHODS OF ANALYSIS, 15TH EDITION, METHOD 973.50, AOAC, ARLINGTON, VIRGINIA (1990).

NITRITE-N
STANDARD METHODS FOR EXAMINATION OF WATER & WASTEWATER, 5TH EDITION, METHOD 4500-NO2 APHA, AWWA, WPCF, WASHINGTON, D.C. (1989).

SOIL: FFNOV2-6'-7'; 11/2/93
PROJECT NAME: NAS FALLON

METHOD REFERENCES (CONTINUED)

BTEX ANALYSIS IN SOILS
EPA SW-846 METHOD 8021: "VOLATILE ORGANIC COMPOUNDS IN WATER BY PURGE AND TRAP CAPILLARY COLUMN GAS CHROMATOGRAPHY WITH PHOTINIZATION AND ELECTROLYTIC CONDUCTIVITY DETECTORS IN SERIES."
REV 0, DECEMBER 1987
U.S. EPA METHOD 602 (FEDERAL REGISTER, VOLUME 49, NO. 209, PG. 43261-43271, OCTOBER 26, 1984).
TEST METHODS FOR EVALUATING SOLID WASTE, EPA PUBLICATION NO. SW-846, SECOND EDITION, METHODS, 8020, 5030, U.S. EPA, WASHINGTON, DC(REVISED APRIL, 1984).

TOTAL ORGANIC CARBON - SOILS)
DETERMINATION OF TOTAL ORGANIC CARBON IN SEDIMENT. LLOYD KAHN, USEPA, REGION II, EDISON, NJ 08837. 7/27/88

TOTAL KJELDAHL NITROGEN-SOIL
SUBCONTRACTED ANALYSIS; EPA 351.3; RMT,INC., MADISON, WI.

TOTAL PHOSPHORUS
EPA 600/4-79-020, METHOD 365.2

PH IN SOILS
TEST METHODS FOR EVALUATING SOLID WASTE. USEPA, SW-846, THIRD EDITION, NOVEMBER 1990, METHOD 9045.

SUBCONTRACTED ANALYSIS
"METHODS OF SOIL ANALYSIS," PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965, PP 307-308. AMERICAN SOCIETY OF AGRONOMY. 1N AMMONIUM ACETATE EXTRACTION. DETERMINATION BY FLAME AA.

SUBCONTRACTED ANALYSIS
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SUBCONTRACTED ANALYSIS
"METHODS OF SOIL ANALYSIS, " PART 2, CHEMICAL AND MICROBIOLOGICAL PROPERTIES, 1965 PP 664-665. AMERICAN SOCIETY OF AGRONOMY. 1N KC1 (ACIDIFIED) EXTRACTION OF SOIL. MEASUREMENT BY ELECTRODE.

SUBCONTRACTED ANALYSIS
ASSAY NAME AND METHOD LISTED ABOVE WITH RESULTS.

TOTAL PETROLEUM HYDROCARBONS/DIESEL
STATE OF CALIFORNIA LUFT METHOD

SOIL: FFNOV2-6'-7'; 11/2/93
PROJECT NAME: NAS FALLON

METHOD REFERENCES (CONTINUED)

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS
WI DNR MODIFIED VERSION OF EPA DRAFT METHOD 9073.

Chain of Custody Record and Analysis Request

Hazleton Environmental Services, Inc.
525 Science Drive
Madison, Wisconsin 53711
Telephone 608-242-2712 ext. 2066
Facsimile 608-233-0502

Enclose with samples and send to:
HES, Inc.
Attn: Sample Entry
515 Science Drive, Madison, Wisconsin 53711

For HES use only
Condition Cold
Acct. # 1080
Smpl Rec'd NOV 05 1993
Date Entered 11-08-93
LIMS # 31100826-
WIP BATT KAB In KAB

Company Name and Address (Please Type or Print)
Battelle
Columbus, Ohio 43201

Project No.
Project Name NAS Fallon
Samplers (signature) J. Kittel

Name of Submitter J. Kittel
Phone No. 614-424-6122
Send Reports To: J. Kittel
Send Invoice To: Accts Payable
Date Sent 11/3/93
Purchase Order No.

Sample Code	Date	Time	Matrix[1]	Sample Description[2]	Number of Containers	Analysis Requested: Particle Size	TKN	Alkalinity, TOC, TPH Exc NH3, Exc FG	Alkalinity, TOC, TPH	As, Pb	TPH (EPA 5), TPH BTEX	Remarks
TS1	11/2/93		Soil	TS1NOV2-2'-3'	2(4oz)	✓	✓					
					3(8oz)			✓	✓	✓		
					1(brass sleeve)						✓	✓
				TS1NOV2-5'-6'	2(4oz)	✓	✓					
					3(8oz)			✓	✓	✓		
					1(brass sleeve)						✓	✓
				TS1NOV2-8'-9'	2(4oz)	✓	✓					
					3(8oz)			✓	✓	✓		
					1(brass sleeve)						✓	✓
TS2				TS2NOV2-3'-4'	2(4oz)	✓	✓					
					3(8oz)			✓	✓	✓		
					1(brass sleeve)						✓	✓

I hereby certify that I received, properly handled, and disposed of these samples as noted above:

Relinquished By (Signature)	Date/Time	Received By (Signature)
J. Kittel	11/3/93 0900	
Relinquished By (Signature)	Date/Time	Received By (Signature)
Relinquished By (Signature)	Date/Time	Received By (Signature)
	11-5-93; 10:00A	Kristie Brekenridge

Remarks (HES use only)
Samples rec'd on ice and in good condition. KB 11.5

1 Specify groundwater, surface water, soil, leachate, sludge, etc.
2 Sample description must clearly correlate the sample ID to the sampling location.

WHITE - Executed Copy YELLOW - HES Copy PINK Client Original

Hazleton Environmental Services, Inc.

525 Science Drive
Madison, Wisconsin 53711
Telephone 608-242-2712 ext. 2066
Facsimile 608-233-0502

Chain of Custody Record and Analysis Request

Enclose with samples and send to:
HES, Inc.
Attn: Sample Entry
515 Science Drive, Madison, Wisconsin 53711

For HES use only
Condition ______ Storage ______
Acct. # ______ Abbrev. ______
Smpl Rec'd NOV 0 5 1993 Init. ______
Date Entered ______
LIMS # ______

Company Name and Address (Please Type or Print

Project No.
Project Name: NAS Fallon
Samplers (signature): [signature]

Name of Submitter: S. Kittel
Phone No.: 614-424-6122
Send Reports To: Same
Send Invoice To: Accts Payable
Date Sent: 11/3/93
Purchase Order No.

Sample Code	Date	Time	Matrix[1]	Sample Description[2]	Number of Containers	Particle size	TKN	Exch NH3, Exch K	Alkalinity, TP, NO3, pH	As, Pb	TPH (SP-5), TPEH	BTEX	Remarks
TS2				TS2NOV3-6'-7'	2 (4oz)	✓	✓						
↓				↓	3 (8oz)			✓	✓	✓			
↓				↓	1 (5.5)	~~✓~~	~~✓~~				✓	✓	
↓				TS2NOV3-8'-9'	2 (4oz)	✓	✓	~~✓~~	~~✓~~	~~✓~~			
↓				↓	3 (8oz)			✓	✓	✓			
↓				↓	1 (5oz)	~~✓~~	~~✓~~				✓	✓	
BK				~~TS2NOV3~~ BKNOV3-2'-3'	2 (4oz)	✓	✓	~~✓~~	~~✓~~	~~✓~~			
↓				↓	3 (8oz)			✓	✓	✓			
↓				↓	1 (5oz)						✓	✓	
↓				BKNOV3-5'-6'	2 (4oz)	✓	✓						
↓				↓	3 (8oz)			✓	✓	✓			
↓				↓	1 (5oz)						✓	✓	

I hereby certify that I received, properly handled, and disposed of these samples as noted above:

Relinquished By (Signature)	Date/Time	Received By (Signature)
[signature]	11/3/93 0900	
	11-5-93 10:00A	Kristie Brenoman

Remarks (HES use only)
Samples rec'd on ice and in good condition. KAB 11-5-93

1 Specify groundwater, surface water, soil, leachate, sludge, etc.
2 Sample description must clearly correlate the sample ID to the sampling location.

WHITE - Executed Copy YELLOW - HES Copy PINK Client Original

1/93

Hazleton Environmental Services, Inc.
525 Science Drive
Madison, Wisconsin 53711
Telephone 608-242-2712 ext. 2066
Facsimile 608-233-0502

Chain of Custody Record and Analysis Request

Enclose with samples and send to:
HES, Inc.
Attn: Sample Entry
515 Science Drive, Madison, Wisconsin 53711

For HES use only
Condition ______ Storage ______
Acct. # ______
Smpl Rec'd NOV 0 5 1993
Date Entered ______
LIMS # ______

Company Name and Address (Please Type or Print: Battelle

Project No.:
Project Name: NAS Fallon
Samplers (signature): [signature]

Name of Submitter: J. Kittel
Phone No.: 614-424-6127
Send Reports To: Same
Send Invoice To: Accts. Payable
Date Sent: 11/3/93
Purchase Order No.:

Sample Code	Date	Time	Matrix[1]	Sample Description[2]	Number of Containers	Particle Size	TKN	[illegible] NH3, Exch K	Alk, CEC, TOC, P, NO3	NO3, pH	As Pb	TPH(SPS) TRPH / BTEX	Remarks
BK	11/3/93	11:00		BKNOV3-7'-8'	2 (4 oz)	✓	✓						
⊥	⊥	⊥		⊥ ⊥	3 (8 oz)			✓	✓	✓			
					1 brass						✓	✓	
FF	11/2/93	1:00		FFNOV3-2'-3'	2 (4 oz)	✓	✓						
				~~6'-7'~~	3 (8 oz)			✓	✓	✓			
					1 brass						✓	✓	
				FFNOV3-6'-7'	2 (4 oz)	✓	✓						
				⊥ ⊥	3 (8 oz)			✓	✓	✓			
	⊥	⊥			1 brass						✓	✓	

I hereby certify that I received, properly handled, and disposed of these samples as noted above:

Relinquished By (Signature)	Date/Time	Received By (Signature)
[signature]	11/3/93 0900	
	11-5-93 @ 10:00A	[signature]

Remarks (HES use only): Samples rec'd on ice + in good condition. KAB 11.5.93

1 Specify groundwater, surface water, soil, leachate, sludge, etc.
2 Sample description must clearly correlate the sample ID to the sampling location.

WHITE - Executed Copy YELLOW - HES Copy PINK Client Original

1/93

APPENDIX H

MCAS KANEOHE BAY
SOIL ANALYTICAL DATA

E.L. Pacific
Environmental Laboratory of the Pacific

Full Service Laboratory for Environmental Analysis
930 Mapunapuna Street, Suite 100 • Honolulu, Hawaii 96819
Telephone: (808) 833-5663 Facsimile: (808) 833-7399

Laboratory Report

Client: Battelle
505 King Ave.
Columbus, OH 43201
Attention: Jeff Kittel

Page: 1 of 3
ELP Project No.: 5090
Report Date: 16-Aug-93

Client PO No.: 60108
Sample Matrix: Soil

Date Collected: 31-Jul-93
Date Received: 02-Aug-93

	Client ID:				K1-3-4'	K2-15-16'	K4-8'-9'
	Matrix:				soil	soil	soil
	Lab ID:			Method Blank	080293-03	080293-04	080293-05
Date	**Analysis**	**Method**	**Units**	**MRL**	**Results**	**Results**	**Results**	**Results**
	BTEX in soil							
04-Aug-93	Extraction	EPA 5030						
04-Aug-93	Benzene	EPA 8020	mg/Kg (ppm)	0.005	ND	<0.005	3.6	ND
04-Aug-93	Toluene	EPA 8020	mg/Kg (ppm)	0.005	ND	<0.005	0.46	ND
04-Aug-93	Ethylbenzene	EPA 8020	mg/Kg (ppm)	0.005	ND	0.42	12	ND
04-Aug-93	Xylenes	EPA 8020	mg/Kg (ppm)	0.010	ND	0.58	23	<0.010
	TPH in soil							
04-Aug-93	Extraction	EPA 3550						
06-Aug-93	Diesel	EPA 8015M	mg/Kg (ppm)	10	ND	2,000	9,200	ND
	Wet Chemistry in soil							
03-Aug-93	pH	EPA 9040	units	0.1	*NR*	7.1	7.7	8.5
13-Aug-93	Alkalinity, CaCO3	EPA 310.1	mg/Kg (ppm)	1	30	500	1,400	800
06-Aug-93	Nitrogen: Total Kjeldahl*	EPA 351.3	mg/Kg (ppm)	40	ND	727	104	102
16-Aug-93	Nitrogen: Nitrate+Nitrite	EPA 353.3	mg/Kg (ppm)	0.5	ND	4.7	1.5	1.8
12-Aug-93	Total Phosphorus	EPA 6010	mg/Kg (ppm)	50	ND	2,300	430	1,000
	Total Metals in soil							
12-Aug-93	Iron	EPA 6010	mg/Kg (ppm)	10	340	190,000	77,000	74,000
	Sieve Analysis							
05-Aug-93	Gradation (% passing)		percent	1	*NR*	100	100	100
05-Aug-93	Gradation (% passing)		percent	3/4	*NR*	100	96.5	100
05-Aug-93	Gradation (% passing)		percent	1/2	*NR*	100	91.7	100
05-Aug-93	Gradation (% passing)		percent	3/8	*NR*	100	90.9	100
05-Aug-93	Gradation (% passing)		percent	4	*NR*	99.9	87.3	99.8
05-Aug-93	Gradation (% passing)		percent	8	*NR*	99.8	85.0	98.7
05-Aug-93	Gradation (% passing)		percent	16	*NR*	99.7	78.1	93.3
05-Aug-93	Gradation (% passing)		percent	30	*NR*	99.5	62.5	87.3
05-Aug-93	Gradation (% passing)		percent	50	*NR*	95.9	53.4	37.6
05-Aug-93	Gradation (% passing)		percent	100	*NR*	90.5	31.7	17.2
05-Aug-93	Gradation (% passing)		percent	200	*NR*	88.2	25.3	12.4

Approved by: _____
Janet Jones, Laboratory Manager

Approved by: _____
Dirk Koeppenkastrop, PhD, Laboratory Director

Quality Control Data

Lab ID:			BS	BSD		MS	MSD	
		Units:	%R	%R	RPD	%R	%R	RPD
Lab ID	Analysis	Method	Results	Results	Results	Results	Results	Results
	BTEX in soil							
073093-02	Benzene	EPA 8020	119	119	0	75	NA	NA
073093-02	Toluene	EPA 8020	117	116	1	79	NA	NA
073093-02	Ethylbenzene	EPA 8020	123	118	4	83	NA	NA
073093-02	Xylenes	EPA 8020	123	91	30	95	NA	NA
	TPH in soil							
080693-09	Diesel	EPA 8015M	109	98	11	94	95	1
	Wet Chemistry in soil							
080693-04	Total Phosphorus	EPA 6010	99	99	0	77	77	0
QRZ31006	Nitrogen: Total Kjeldahl*	EPA 351.3	98	NA	NA	77	NA	NA
080293-04	Nitrogen: Nitrate+Nitrite	EPA 353.3	99	108	9	67	NA	NA
	Total Metals in soil							
080693-04	Iron	EPA 6010	85	84	1	*	*	*

Lab ID:			OS	D	
		Units:	mg/Kg	mg/Kg	RPD
Lab ID	Analysis	Method	Results	Results	Results
	Wet Chemistry in soil				
080293-05	pH	EPA 9040	8.5	8.4	1.2
080293-03	Alkalinity, CaCO3	EPA 310.1	50	50	0.0

Comment: *Native analyte greater than 4 times the spike added therefore recovery not calculable.

Approved by: _____
Janet Jones, Laboratory Manager

Approved by: Brenda L. Olive (for)
Dirk Koeppenkastrop, PhD, Laboratory Director

Definitions

MRL	Method Reporting Limit
ND	Not Detected
NR	Not Requested
NA	Not Applicable
BS	Blank Spike (Laboratory Control Sample)
BSD	Blank Spike Duplicate
MS	Matrix Spike
MSD	Matrix Spike Duplicate
OS	Original Sample
D	Duplicate
RPD	Relative Percent Difference
%R	Percent Recovery
PDS	Post Digestion Spike

Approved by: _____
Janet Jones, Laboratory Manager

Approved by: Brenda L. Olivier (for)
Dirk Koeppenkastrop, PhD, Laboratory Director

ENVIRONMENTAL LABORATORY OF THE PACIFIC

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LABORATORY USE ONLY
LAB JOB NO. 52090
LAB DUE DATE (12) Aug 93
LOCATION Ref #5 - 1100 ...

Chain of Custody / Analysis Request Form

Project Manager: Jeff Kittel

Name: Battelle	Project I.D.
Address: 505 King Ave	Job Name
Columbus Ohio 43201	Job Number
Phone 614-424-6122 · FAX 614-424-3667	P.O. Number 60108

3. Sampled by (Please Print)	4. # of Samples in Shipment	5. Date of Sample Shipment	6. Date Results Needed
J.A. Kittel	3 (2 btls ea)	8/2	Normal Turn

Indicate Analysis Requested

Item No.	Sample Number	Sample ID	COMP	GRAB	Matrix	Preservation Method	Sampling Date	Sampling Time	Number of Containers	TPH	TDS / BTEX	Alkalinity	Soil pH	Sieve analysis	Phosphorus (subbed)	TKN	NO_2 + NO_3	Total Fe (added 8/9/93)			Laboratory Number
1		K1-3-4'	X		✓	ice	7/31/93		2	✓	✓	✓	✓	✓	✓	✓	J	+			080293-03
2		K2-15'-16'	X		✓	"	7/31		2	✓	✓	✓	✓	✓	✓	✓	J	+			04
3		K4-8'-9'			✓	"	7/31		2	✓	✓	✓	✓	✓	✓	✓	J	+			05
4																					
5																					Have been composited.
6																					
7																					
8																					
9																					
10																					

Lab ID ______

Released by (Signature)	Date / Time Released	Delivery Method	Received by (Signature)	Company / Agency Affiliation	Date/Time Received	Condition Noted
Jeff Kittel	8/2/93 1:15pm	Hand	[signature]	ELP	8/2/93 1:15pm	Good - 12°C

Comments: Treat each group of two samples as 1 composite sample.

Please Check Box
☒ Dispose by Lab
☐ Return to Client
☐ Archive